LUCIUS ANNAEUS SENECA

Natural Questions

translated by HARRY M. HINE

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THE COMPLETE WORKS OF LUCIUS ANNAEUS SENECA

Edited by Elizabeth Asmis, Shadi Bartsch, and Martha C. Nussbaum

Seneca
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TRANSLATED BY HARRY M. HINE

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Contents

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Seneca once remarked of Socrates that it was his death by hemlock that made him great (*Letter* 13.14). With reason: Socrates' death demonstrated the steadfastness of his philosophical principles and his belief that death offered nothing to fear. When Seneca himself, then, was ordered to commit suicide by Nero in 65 CE, we might well believe Tacitus's account in his *Annals* (15.63) that the Roman Stoic modeled his death on that of Socrates, discoursing calmly about philosophy with his friends as the blood drained out of his veins. In Tacitus's depiction we see, for once, a much-criticized figure living up to the principles he preached.

Seneca's life was mired in political advancement and disappointment, shaped by the effects of exile and return, and compromised by his relationship with the emperor Nero—first his pupil, then his advisee, and finally his murderer. But his many writings say little about his political career and almost nothing about his relationship with Nero except for what can be gleaned from his essay *On Clemency*, leaving us to turn to later sources for information—Tacitus, Suetonius, and Dio Cassius in particular. We know that Seneca was born to a prominent equestrian family in Corduba, Spain, some time between 4 and 1 BCE. He was the second of three sons of Helvia and Lucius Annaeus Seneca (the youngest son, Annaeus Mela, was the father of the poet Lucan). The elder Seneca had spent much of his life in Rome, and Seneca himself was brought to Rome as a young boy. There he was educated in rhetoric and later became a student of the philosopher Sextius. But his entry into political life was delayed, and when he did enter upon the *cursus honorum* late in Tiberius's reign, his ill health (he had asthma and possibly tuberculosis) was a source of difficulty. In any case his career was cut short. He survived Caligula's hostility, which the sources tell us was thanks to his talents in oratory, but was sent into exile on Corsica by Claudius shortly after Caligula's death in 41 CE. The charge, almost certainly false, was adultery with Caligula's younger sister, Julia Livilla. Seneca spent his time in exile in philosophical and natural study and wrote

the *Consolations* to Helvia (his mother) and to Polybius (Claudius's freedman secretary), revealing in the latter how desperately he hoped to be recalled to Rome.

When Seneca did return in 49 CE, it was under different auspices. Claudius had recently remarried, to Germanicus's daughter Agrippina, and she urged him to recall Seneca as tutor to her son, the twelve-year-old Nero. Claudius already had a younger son, Britannicus, but it was clear that the wily Agrippina wished to see her own flesh and blood on the throne. When Claudius died five years later, Agrippina was able to maneuver Nero into position as emperor—and Britannicus was dispatched by poison shortly after, in 55 CE.

From 54 until his influence waned at the end of the decade, Seneca acted as Nero's advisor, together with the praetorian prefect Sextus Afranius Burrus. We know he wrote a speech on clemency for Nero to deliver to the Senate soon after his accession, and Seneca's own essay *On Clemency* may contain some inkling of his strategy to keep the young emperor from running amok. Seneca's use of the term *rex*, or king, applied to Nero by analogy in this piece, is surprising from a Roman senator, but he seems to have hoped that flattering Nero by pointing to his limitless power and the value of clemency would be one way to keep him from abusing that power. Both Seneca and Burrus also helped with the civil and judicial administration of the empire.

Many historians, ancient and modern, feel that this early part of Nero's reign, moderated by Seneca and Burrus, represented a period of comparative good rule and harmony (the "*quinquennium Neronis*"). The decline started in 59 CE with Nero's murder of Agrippina, after which Seneca wrote the emperor's speech of self-exculpation—perhaps the most famous example of how the philosopher found himself increasingly compromised in his position as Nero's chief counsel. Certainly as a Stoic, Seneca cuts an ambiguous figure next to the others who made their opposition to Nero clear, such as Thrasea Paetus and Helvidius Priscus. His participation in court politics probably led him to believe that he could do more good from where he stood than by abandoning Nero to his own devices—if he even had this choice.

In any case, Seneca's influence over Nero seems to have been considerably etiolated after the death of Burrus in 62. According

to Tacitus, Seneca tried to retire from his position twice, in 62 and 64. Although Nero refused him on both occasions, Seneca seems to have largely absented himself from the court after 64. In 65 CE came the Pisonian conspiracy, a plot to kill Nero and replace him with the ringleader, C. Calpurnius Piso. Although Seneca's nephew Lucan was implicated in this assassination attempt, Seneca himself was probably innocent. Nonetheless, Nero seized the opportunity to order his old advisor to kill himself. Seneca cut his own veins, but (so Tacitus tells us) his thinness and advanced age hindered the flow of blood. When a dose of poison also failed to kill him, he finally sat in a hot bath to make the blood flow faster. His wife, Pompeia Paulina, also tried to commit suicide but was saved on orders from Nero.

Because of his ethical writings, Seneca fared well with the early Christians—hence the later forging of a fake correspondence with St. Paul—but already in antiquity he had his fair share of critics, the main charge arising from the apparent contradiction between his Stoic teachings on the unimportance of "externals" and his own amassing of huge wealth. Perhaps for this reason he never gained the respect accorded the "Roman Socrates," the Stoic C. Musonius Rufus, banished by Nero in 65, even though Seneca's writings have had far more influence over the centuries. In Seneca's own lifetime one P. Suillius attacked him on the grounds that, since Nero's rise to power, he had piled up some 300 million sesterces by charging high interest on loans in Italy and the provinces—though Suillius himself was no angel and was banished to the Balearic Islands for being an embezzler and informant. In Seneca's defense, he seems to have engaged in ascetic habits throughout his life and despite his wealth. In fact, his essay *On the Happy Life (De vita beata)* takes the position that a philosopher may be rich as long as his wealth is properly gained and spent and his attitude to it is appropriately detached. Where Seneca finally ranks in our estimation may rest on our ability to tolerate the various contradictions posed by the life of this philosopher in politics.

A Short Introduction to Stoicism

Stoicism is one of the world's most influential philosophical movements. Starting from the works and teaching of the three original heads of the Greek Stoic school—Zeno of Citium (335–263 BCE),

Cleanthes (331–232 BCE), and Chrysippus (ca. 280–207 BCE)—it became the leading philosophical movement of the ancient Greco-Roman world, shaping the development of thought well into the Christian era. Later Greek Stoics Panaetius (ca. 185–109 BCE) and Posidonius (ca. 135–51 BCE) modified some features of Stoic doctrine. Roman thinkers then took up the cause, and Stoicism became the semiofficial creed of the Roman political and literary world. Cicero (106–43 BCE) does not agree with the Stoics on metaphysical and epistemological matters but his ethical and political positions lie close to theirs, and even when he does not agree, he makes a concerted effort to report their positions sympathetically. Roman Stoics Seneca, Epictetus (mid-first to early second century CE), Musonius Rufus (ca. 30–ca. 102 CE), and the emperor Marcus Aurelius (121–80 CE, emperor 161–80) produced Stoic works of their own (the last three writing in Greek).

The philosophical achievement of the Greek Stoics, and especially that of Chrysippus, was enormous: the invention of propositional logic, the invention of the philosophy of language, unprecedented achievements in moral psychology, distinction in areas ranging from metaphysics and epistemology to moral and political philosophy. Through an accident of history, however, all the works of all the major Greek Stoics have been lost, and we must recover their thoughts through fragments, reports (particularly the lengthy accounts in Diogenes Laertius's *Lives of the Philosophers*, in Cicero, and in Sextus Empiricus's skeptical writings since the Stoics are his primary target), and the works of the Roman thinkers—who often are adjusting Stoic doctrines to fit Roman reality and probably contributing creative insights of their own. This also means that we know somewhat less about Stoic logic or physics than about Stoic ethics, since the Romans took a particular interest in the practical domain.

The goal of Stoic philosophy, like that of other philosophical schools of the Hellenistic era, was to give the pupil a flourishing life free from the forms of distress and moral failure that the Stoics thought ubiquitous in their societies. Unlike some of their competitor schools, however, they emphasized the need to study all parts of their threefold system—logic, physics, and ethics—in order to understand the universe and its interconnections. To the extent that a Roman such as Cicero believed he could uphold the moral truths of

Stoicism without a confident belief in a rationally ordered universe, he held a heretical position (one shared many centuries later by Immanuel Kant).

Stoic physics held that the universe is a rationally ordered whole, and that everything that happens in it happens for the best of reasons. (It is this position, in its Leibnizian incarnation, that is pilloried in Voltaire's *Candide*.) Rejecting traditional anthropomorphic religion, the Stoics gave the name Zeus to the rational and providential principle animating the universe as a whole, and they could find even in the most trivial or distressing events (such as earthquakes and thunderbolts) signs of the universe's overall good order. This order was also a moral order based on the inherent dignity and worth of the moral capacities of each and every rational being. The Stoics believed that this order was deterministic: everything happens of necessity. But they were also "compatibilists," believing that human free will was compatible with the truth of determinism. They engaged in spirited debates with "incompatibilist" Aristotelians, making lasting contributions to the free will controversy.

Stoic ethics begins from the idea of the boundless worth of the rational capacity in each and every human being. The Roman Stoics understood this capacity to be centrally practical and moral. (Thus, unlike Plato, they did not think that people who had a natural talent for mathematics were better than people who didn't, and they became more and more skeptical that even the study of logic had much practical value.) They held that all human beings were equal in worth by virtue of their possession of the precious capacity to choose and direct their lives, ranking some ends ahead of others. This, they said, was what distinguished human beings from animals: this power of selection and rejection. (Unlike most other ancient schools, they had little concern for the morality of animal treatment, since they thought that only moral capacity entitled a being to respect and good treatment.) Children, they said, came into the world like little animals, with a natural orientation toward self-preservation but no understanding of true worth. Later, however, a remarkable shift would take place, already set up by their possession of innate human nature: they would become able to appreciate the beauty of the capacity for choice and the way in which moral reason had shaped the entire universe. This recognition, they said, should lead people to

respect both self and others in an entirely new way. Stoics were serious about (human) equality: they urged the equal education of both slaves and women. Epictetus himself was a former slave.

Stoicism looks thus far like an ethical view with radical political consequences, and so it became during the Enlightenment, when its distinctive emphases were used to argue in favor of equal political rights and more nearly equal economic opportunities. However, the original Stoics maintain a claim of great significance for politics: moral capacity is the only thing that has intrinsic worth. Money, honor, power, bodily health, and even the love of friends, children, and spouse—all these are held to be things that one may reasonably pursue if nothing impedes (they are called "preferred indifferents"), but they have no true intrinsic worth. They cannot rightly even be commensurate with moral worth. So when they do not arrive as one wishes, it is wrong to be distressed.

This was the context in which the Stoics introduced their famous doctrine of *apatheia*, freedom from the passions. Defining the major emotions or passions as all involving a high valuation of "external goods," they argue that the good Stoic will not have any of these disturbances of the personality. Realizing that chance events lie beyond our control, the Stoic will find it unnecessary to experience grief, anger, fear, or even hope: all of these are characteristic of a mind that waits in suspense, awestruck by things indifferent. We can have a life that truly involves joy (of the right sort) if we appreciate that the most precious thing of all, and the only truly precious thing, lies within our control at all times.

Stoics do not think that it is at all easy to get rid of the cultural errors that are the basis of the rejected passions: thus a Stoic life is a constant therapeutic process in which mental exercises are devised to wean the mind from its unwise attachments. Their works depict processes of therapy through which the reader may make progress in the direction of Stoic virtue, and they often engage their reader in just such a process. Epictetus and Marcus Aurelius describe processes of repeated meditation; Seneca (in *On Anger*) describes his own nightly self-examination. Seneca's *Letters* show the role that a wiser teacher can play in such a therapeutic process, but Seneca evidently does not think that even he himself is free from erroneous attachments. The "wise man" is in that sense a distant ideal, not a worldly reality, par-

ticularly for the Roman Stoics. A large aid in the therapeutic process is the study of the horrible deformities that societies (including one's own) suffer by caring too much about external goods. If one sees the ugly face of power, honor, and even love clearly enough, this may assist one in making the progress toward true virtue. Thus Seneca's *On Anger* is an example of a genre that we know to have been common in Stoicism.

Because of their doctrine of value, the Stoics actually do not propose radical changes in the distribution of worldly goods, as one might suppose equal regard for the dignity of all human beings would require. They think that equal respect does require dignified treatment of each person; thus Seneca urges masters not to beat their slaves or use them as sexual tools. About the institution of slavery, however, there is silence, and worse than silence: Seneca argues that true freedom is internal freedom, so the external sort does not really matter. Musonius, similarly, advocates respectful treatment for women, including access to a Stoic education. But as for changes in the legal arrangements that confined women to a domestic role and gave males power of life and death over them, he too is silent, arguing that women will manifest their Stoic virtue in the domestic context. Some Roman Stoics do appear to have thought that political liberty was a part of dignity, and thus died supporting republican institutions, but whether this attention to external conditions was consistent with Stoicism remains unclear. (Certainly Cicero's profound grief over the loss of political freedom was not the attitude of a Stoic, any more than was his agonizing grief over his daughter's death.)

There was also much debate about whether the Stoic norm of *apatheia* encouraged people to detach themselves from bad political events in a way that gave aid and comfort to bad politics. Certainly Stoics were known to counsel retirement from politics (a theme in Seneca's own life as he sought Nero's permission for retirement, unsuccessfully), and they were thought to believe that upheaval was worse than lawless tyranny. Plutarch reports that Brutus (a Platonist) questioned potential coconspirators in the assassination of Julius Caesar by trying to determine whether they accepted that Stoic norm or believed, with him, that lawless tyranny was worse than civil strife; only non-Stoics were selected for the group of assassins. During Nero's reign, however, several prominent Stoics—including

Seneca and his nephew Lucan—joined republican political movements aimed at overthrowing Nero, and lost their lives for their efforts, by politically ordered suicide.

Stoics believed that from the moral point of view, national boundaries were as irrelevant as honor, wealth, gender, and birth. They held that we are, first and foremost, citizens of the universe as a whole. (The term *kosmou polites*, citizen of the universe, was apparently first used by Diogenes the Cynic, but the Stoics took it up and were the real forefathers of modern cosmopolitanism.) What cosmopolitanism meant in practical terms was unclear, for the reasons already given—but Cicero thinks, at any rate (in *On Duties*, a highly Stoic work), that our common human dignity entails some very strict limits on the reasons for going to war and the sort of conduct that is permissible in it. He thus adumbrated the basis of the modern law of war. Cicero denied, however, that our common humanity entailed any duty to distribute material goods beyond our own borders, thus displaying the unfortunate capacity of Stoic doctrine to support the status quo. Cicero's *On Duties* has had such an enormous influence on posterity in this that it is scarcely an exaggeration to blame the Stoics for the fact that we have well worked-out doctrines of international law in the area of war and peace, but no well-established understanding of our material duties to one another.

Stoicism's influence on the development of the entire Western intellectual tradition cannot be underestimated. Christian thought owes it a large debt. Clement of Alexandria is just one example of a Christian thinker steeped in Stoicism; even a thinker such as Augustine, who contests many Stoic theses, finds it natural to begin from Stoic positions. Even more strikingly, many philosophers of the early modern era turn to Stoicism for guidance—far more often than they turn to Aristotle or Plato. Descartes' ethical ideas are built largely on Stoic models; Spinoza is steeped in Stoicism at every point; Leibniz's teleology is essentially Stoic; Hugo Grotius bases his ideas of international morality and law on Stoic models; Adam Smith draws more from the Stoics than from other ancient schools of thought; Rousseau's ideas of education are in essence based on Stoic models; Kant finds inspiration in the Stoic ideas of human dignity and the peaceful world community; and the American founders are steeped in Stoic ideas, including the ideas of equal dignity and cosmopoli-

tanism, which also deeply influence the American transcendentalists Emerson and Thoreau. Because the leading works of Greek Stoicism had long been lost, all these thinkers were reading the Roman Stoics. Because many of them read little Greek, they were primarily reading Cicero and Seneca.

The Stoic influence on the history of literature has also been immense. In the Roman world, all the major poets, like other educated Romans, were acquainted with Stoic ideas and alluded to them often in their work. Virgil and Lucan are perhaps particularly significant in this regard. Later European literary traditions also show marked traces of Stoic influence—in part via the influence of Roman literature, and in part through the influence of philosophers in their own time who were themselves influenced by Stoic thought, but often also through their own reading of the influential works of Cicero, Seneca, and Marcus Aurelius.

Seneca's Stoicism

Seneca identifies himself as a Stoic. He declares his allegiance by repeatedly referring to "our people" (*nostri*)—the Stoics—in his writings. Yet he exercises considerable independence in relation to other Stoics. While he is committed to upholding basic Stoic doctrines, he recasts them on the basis of his own experience as a Roman and a wide reading of other philosophers. In this respect he follows a tradition of Stoic philosophical innovation exemplified most clearly by Panaetius and Posidonius, who introduced some Platonic and Aristotelian elements while adapting Stoicism to Roman circumstances. Seneca differs from previous Stoics by welcoming some aspects of Epicurean philosophy along with other influences.

Seneca is concerned above all with applying Stoic ethical principles to his life and to the lives of others like him. The question that dominates his philosophical writings is how an individual can achieve a good life. In his eyes, the quest for virtue and happiness is a heroic endeavor that places the successful person above the assaults of fortune and on a level with god. To this end, Seneca transforms the sage into an inspirational figure who can motivate others to become like him by his gentle humanity and joyful tranquility. Key topics are how to reconcile adversity with providence, how to free oneself from passions (particularly anger and grief), how to face death, how to dis-

engage oneself from political involvement, how to practice poverty and use wealth, and how to benefit others. All of these endeavors are viewed within the context of a supreme, perfectly rational and virtuous deity who looks with favor on the efforts of humans to attain the same condition of virtue. In the field of politics, Seneca argues for clemency on the part of the supreme ruler, Nero. In human relations, he pays special attention to friendship and the position of slaves. Overall, he aims to replace social hierarchies, with their dependence on fortune, with a moral hierarchy arranged according to proximity to the goal of being a sage.

Seneca's own concerns and personality permeate his writings. The modern reader learns much about the life of an aristocrat in the time of Claudius and Nero, and much about Seneca's personal strengths and weaknesses. At the same time, there is also much in the work that transcends the immediate concerns of Seneca and his period. Some topics that resonate especially with a modern audience are his vision of humans as members of a universal community of mankind, the respect he demands for slaves, his concern with human emotions, and, in general, his insistence on looking within oneself to find happiness. What is perhaps less appealing to the modern reader is the rhetorical elaboration of his message, which features an undeniable tendency toward hyperbole. Most of all, Seneca's own character strikes many readers as problematic. From his own time on, he was perceived by some as a hypocrite who was far from practicing what he preached. Some of Seneca's writings (in particular, his *Consolations* to Polybius and his mother Helvia, and his essay *On the Happy Life*) are obviously self-serving. As Seneca himself suggests (*Letters* 84), he has transformed the teachings he has culled, in the manner of bees, into a whole that reflects his own complex character.

The Stoics divided logic into dialectic (short argument) and rhetoric (continuous exposition). There is not much to be said on dialectic in Seneca's writings except that he shuns it, along with formal logic in general. Every so often, however, he engages in a satirical display of fine-grained Stoic-type reasoning. The point is that carrying logical precision to excess is futile: it does not make a person any better. Quibbles of all kinds should be avoided, whether they involve carrying through a minute line of argument, making overly subtle verbal distinctions, or indulging in abstruse philological interpreta-

tion. While making the point, Seneca makes sure the reader knows he could beat the quibbler at his own game if he wanted to.

We have only sparse details about how the Stoics viewed rhetoric. What is clear about Seneca, however, is that he used the full panoply of Roman rhetorical methods to persuade readers of his philosophical message. His writings are full of vivid examples, stunning metaphors, pointed sayings, ringing sound effects. He knows how to vary his tone, from casual conversation to soaring exhortation and bitter denunciation. He peoples his text with a varied cast of characters: the addressee, the implied audience, hypothetical objectors, friends, opponents, historical figures. He himself hovers over the proceedings as watchful friend and sometime foe. Following Cleanthes, he intersperses poetry into his prose to impel the reader even more forcefully toward the task of self-improvement.

Given Seneca's ethical aims, it is perhaps surprising that he devotes a large work, *Natural Questions*, to physics. Yet the entire work has an overarching ethical aim. As Seneca insists repeatedly, the mind is uplifted by venturing beyond narrowly human concerns to survey the world as a whole. The contemplation of the physical world complements moral action by showing the full context of human action: we see god in his full glory, caring for human lives as he administers the world as a whole. In the spirit of Lucretius (who championed a rival philosophy), Seneca also intersperses ethical messages throughout his physical inquiries. Thus he emphasizes that humans must confront natural events, such as death and natural disasters, with courage and gratitude to god; and he warns against human misuse of natural resources and the decadence that accompanies progress. Of all areas of inquiry, physics affords Seneca the greatest scope for making additions and corrections to Stoic doctrine. He ranges over the whole history of physical inquiries, from the Presocratics to his own time, to improve upon the Stoics.

Seneca writes (*Letters* 45.4) that while he believes "in the judgment of great men," he also claims something for his own judgment: previous philosophers left some things to be investigated by us, which they might indeed have discovered for themselves if they hadn't engaged in useless quibbles. Granted that Seneca shows special investigative fervor in his cosmological inquiries, his moral teachings too are a product of his own judgment and innovation. What he contributes

is a new vision rather than new theories. Using certain strict Stoic distinctions as a basis, he paints a new picture of the challenges that humans face and the happiness that awaits those who practice the correct philosophy. In agreement with Stoic orthodoxy, Seneca is uncompromising about differentiating between external advantages and the good, about the need to eradicate the passions, about the perfect rationality of the wise person, about the identity of god with Fate. What he adds is a moral fervor, joined by a highly poetic sensibility, that turns these distinctions into springboards for action.

The Stoic sage was generally viewed by critics as a forbidding figure, outside the reach of human capabilities and immune to human feeling. Seneca concedes, or rather emphasizes, that the sage is indeed rare; he remarks that the sage is like a phoenix, appearing perhaps every five hundred years (*Letters* 42.1). As he sees it, the sage's exceptional status is not a barrier to improvement; it inspires. Seneca gives real-life immediacy to the sage by citing the younger Cato, opponent of Julius Caesar, as an example. Cato, indeed, is not just any sage; Seneca says he is not sure whether Cato might even surpass *him* (*On Constancy* 7.1). In this he is not blurring Stoic distinctions, but highlighting the indomitable moral strength of a sage. Through Cato and numerous other examples from the Roman past, Seneca fuses the Stoic sage with the traditional image of a Roman hero, thus spurring his Roman readers to fulfill their duties by emulating both at once.

Below the level of sage, Seneca outlines three stages of moral progress, demarcated according to our vulnerability to irrational emotions (*Letters* 75). There is the condition very near to that of being a sage, in which a person is not yet confident of being able to withstand irrational emotions (the so-called passions, *pathê*). Just below it is the stage in which a person is still capable of lapsing, and at the lowest level of progress a person can avoid most irrational emotions, but not all. Below these are the innumerable people who have yet to make progress. Seneca has nothing to say to them; he wants to avoid them, lest he be contaminated. What he does allow is that persons who are still struggling to become good may give way to grief initially; but he insists that this period must be brief. The Stoics talk "big words," he says, when they forbid moans and groans; he'll adopt a more gentle tone (*Letters* 23.4). Still, he insists, these words are "true"; and his aim

is to lead, as much as he can, to the goal of a dispassionate attitude toward externals. Like everyone, the wise person is prone to initial shocks—reactions that look momentarily like irrational emotions—but these are involuntary responses to be succeeded immediately by the calmness of judgment. Seneca's sage is kind to others and is filled with a serene joy that has nothing to do with the ephemeral pleasure that other people take in externals.

Looking toward Roman heroism, Seneca portrays moral progress as an arduous struggle, like a military campaign or the uphill storming of an enemy's position. The enemy is fortune, viciously attacking her victim in the form of the most cruel disasters. Her opponent may succumb, but he will have conquered fortune if he resists to the end. In reality, the disasters come from other people or simply from circumstances. Seneca commonly cites death (whether one's own or that of a loved one), exile, torture, and illness. His own life is rich with examples. He goes so far as to advocate adversity as a means of making moral progress, but he also allows (with a view to his own wealth) that favorable circumstances are a help to the person who is still struggling to make progress.

To make progress, a person must not only confront externals but also, above all, look within oneself. Drawing inspiration from Plato, Seneca tells us there is a god inside; there is a soul that seeks to free itself from the dross of the body. Seneca invites the reader to withdraw into this inner self, so as to both meditate on one's particular condition and take flight in the contemplation of god. This withdrawal can occur in the press of a very active life. But it's easier when one is no longer fully caught up in politics, and so Seneca associates moral withdrawal with his own attempt to withdraw from politics toward the end of his life. He insists that he will continue to help others through his philosophical teachings, like other Stoics.

Senecan Tragedy

From Seneca's hand there survive eight tragedies (*Agamemnon*, *Thyestes*, *Oedipus*, *Medea*, *Phaedra*, *Phoenissae*, *Troades*, *Hercules Furens*), not including the spurious *Octavia* and the probably spurious *Hercules Oetaeus;* of the *Phoenissae* there remain only fragments. These dramas have undergone many vicissitudes in fortune throughout the centuries; however, they are no longer criticized as being mere

flawed versions of the older Greek dramas in which much of Seneca's subject matter had already been treated. While Seneca's plays were once mined only for the light they shed on Roman Stoic philosophy, for examples of rhetorical extravagance, or for the reconstruction of missing plays by Sophocles and his fellows, the traits that once marked the dramas as unworthy of critical attention now engage us in their own right. Indeed, they are the only extant versions of any Roman tragedy, the writings of other dramatists such as Marcus Pacuvius (ca. 220–130 BCE) and Lucius Accius (ca. 170–86 BCE) having been lost to posterity. It is thus only Seneca's version of Roman drama, translated into English as the *Tenne Tragedies* in 1581, that so influenced the tragedians of the Elizabethan era.

Seneca may have turned his hand to writing drama as early as the reign of Caligula (37–41 CE), although there is no way of determining exactly when he began. Our first reference to the plays comes from a famous graffito from the *Agamemnon* preserved on a wall in Pompeii, but we can only deduce that this was written before the eruption of Vesuvius in 79 CE; it is of little actual use in trying to date the dramas. Stylistic analysis has not provided us with a sure order of composition, though scholars seem to agree that the *Thyestes* and the *Phoenissae* are late efforts. Certainly we are unable to make claims about their dating with respect to the *Essays* and *Letters*, despite the very different tones of Seneca's prose and his poetry—a difference that led some readers, including the fifth-century churchman and orator Sidonius Apollinaris and after him Erasmus and Diderot, to speculate (erroneously) that there might have been two Lucius Annaeus Senecas at work on them rather than one.

This confusion about the authorship of Seneca's writing may seem natural, given the argument that Stoicism fails as a way of life in the dramas. Whether it fails because its adherents are too weak to resist the pull of desire or emotion, because Stoicism itself is too difficult to practice successfully, because the universe is not the locus of a divine Providence, or because the protagonists are so evil that they fail to see Providence in action, is open to argument; a metaliterary view might even suggest that plotlines inherited from mythology provide the force that condemns a Cassandra or a Polyxena to death at the hands of a Clytemnestra or a Ulysses, with Seneca taking advantage of this dramatic fact to suggest the inexorable workings

of Fate and the futility of struggle against it. Consider the *Thyestes* (a topic often dramatized in the Late Republic, though Seneca's version is the only one we have). We meet the eponymous exile as he praises the pauper's life to his children—only the man who drinks out of earthenware cups can be truly happy and without fear, he reminds them—but when invited to return to the palace at Argos by his conniving brother Atreus, the source of his exile, he allows himself to be lured back after only a token hesitation about giving up his newfound equanimity. "Sequor," he says to his son, "I follow you"; but in following his appetite for the luxurious life he does the opposite of the good Stoic.

The rest is, well, the stuff of myth. Dressed in royal regalia, Thyestes sits down to enjoy a hearty stew and some fine red wine, but his satiated belches soon turn into howls of horror as the delighted Atreus informs him of his dinner's provenance: the meal is made up of the dismembered bodies of Thyestes' own sons. Is there an explicit ethical or philosophical message here? If we followed the view of another Stoic, Epictetus (ca. 55–ca. 135 CE), who defined tragedy as what happens "when chance events befall fools" (*Discourses* 2.26.31), we might conclude that the story of Thyestes precisely illustrates the folly of giving in to a desire for power (or haute cuisine). In Seneca's treatment, however, such a clear object lesson seems undermined by a number of factors: the fact that Atreus reigns triumphant as the drama ends; the undeniable echoes of Stoic exhortation in the impotent counsels of Atreus's adviser; and the fragility of civic and religious values—the hellish scene in which Atreus sacrifices the children represents precisely a travesty of sacrifice itself, while *xenia* (the ancient tradition of hospitality) fares still worse. The adviser or a nurse mouthing Stoic platitudes without effect is featured in many of the plays: Phaedra, Clytemnestra, and Medea all have nurses to counsel them against their paths of action, even though their advice is invariably distorted and thrown back in their faces. Creon plays a similar role in the *Agamemnon*.

Other Senecan protagonists have more lasting doubts than Thyestes about the value of earthly success. Oedipus asks: "Joys any man in power?" And unlike his more confident Sophoclean manifestation, he feels the answer is clearly no. From the beginning of the play, the *Oedipus* provides striking contrasts to its Greek prec-

edent, whose emphasis on the discovery of identity yields here to the overwhelming sense of pollution affecting Oedipus. The king, anxious even as the drama opens, worries that he will not escape the prophecy of his parricide, and suspects he is responsible for the plague ravaging Thebes. Despondent, he hopes for immediate death; his emotional state is far different from that of the character at the center of Sophocles' play. Seneca's version also features Creon's report of the long necromantic invocation of Laius's ghost in a dark grove, something absent in Sophocles. Even the sense that the characters' interaction onstage fails to drive the drama makes sense in the context of Seneca's forbidding and inexorable dramatic world. Causality and *anagnorisis* (dramatic recognition) are put aside in favor of the individual's helplessness before what awaits him, and the characters' speeches react to the violence rather than motivate it.

The pollution of the heavens by humans goes against Stoic physics but finds its place in the plays. The Stoics posited a tensional relationship between the cosmos and its parts; according to this view, the *pneuma* or vital spirit that subtends all matter results in a cosmic sympathy of the parts with the whole. "All things are united together . . . and earthly things feel the influence of heavenly ones," as Epictetus (*Discourses* 1.4.1) puts it. But what we see in the dramas is a disquieting manifestation of this *sympatheia:* the idea that the wickedness of one or a few could disrupt the rational and harmonic logos of the entire cosmos represents a reversal of the more orthodox Stoic viewpoint that the world is accessible to understanding and to reason. Thus we see the universe trembling at Medea's words, and the law of heaven in disorder. In the *Thyestes*, the sun hides its face in response to Atreus's crime; in the *Phaedra*, the chorus notes an eclipse after Phaedra's secret passion is unveiled. Horrific portents presage what is to come in the *Troades*. In Seneca's dramas, unlike in Greek tragedy, there is no role for civic institutions or the city to intervene in this relationship. The treatment of the gods is similarly unorthodox. Although Jason calls upon Medea to witness that there are no gods in the heavens, the very chariot in which she flies away is evidence of the assistance given her by her divine father. The gods are there; the problem is that they are unrecognizable.

Seneca's great antiheroes like Medea and Thyestes are troubling not only because they often triumph, but because the manner of

their triumph can resemble the goal point of the aspiring Stoic: in exhorting themselves to take up a certain stance towards the world, in abandoning familial and social ties, in rejecting the moral order of the world around them, and in trying to live up to a form of selfhood they have judged to be "better," Seneca's tyrants, just like his sages, construct a private and autonomous world around themselves which nothing can penetrate. Not only do they borrow the self-exhortations and self-reproving of the Stoic's arsenal, in which the dialogue conducted with the self suggests a split between a first-order desiring self and a second-order judging self, but they also adopt the consideration of what befits or is worthy of them as a guiding principle—always with a negative outcome.

This leads in turn to a metatheatrical tinge in several of the plays. In the *Medea*, for example, Medea seems to look to prior versions of her own story to discover what exactly is appropriate for her persona, in the same way that Oedipus, after putting out his eyes, remarks that "*This* face befits (an) Oedipus" (*Oedipus* 1000) or that Atreus says of his recipe, "This is a crime that befits Thyestes—and befits Atreus" (*Thyestes* 271). Such metatheatricality seems to draw upon the concern of the traditional Roman elite to perform exemplary actions for an approving audience, to generate one's ethical exemplarity by making sure that spectators for it exist.

And spectators do exist—we, the theater audience or the recitation audience. Scholars have long debated the question of whether Seneca's dramas were staged in antiquity. It is possible, as argued by the nineteenth-century German scholar Friedrich Leo, the tragedies were written for recitation only; inter alia, it would be unusual (but not impossible) to represent animal sacrifice and murder on stage. The question is unresolvable, but whether the original audiences were in the theater or in the recitation room, they shared with us the full knowledge of how the story would turn out, and in this they uncomfortably resembled some of the plotting antiheroes themselves. Indeed, our pleasure in watching Senecan tragedy unfold might seem to assimilate us to the pleasure these characters take in inflicting suffering on one another. In a famous line from the *Troades*, the messenger who brings news of Astyanax's murder reports of the scene of his death—which he has already compared to a theater—that "The greater part of the fickle crowd abhors the crime—and watches it"

(1128–29). Here, in the tension between sadistic voyeurism and horror at what the drama unfolds, we can recognize the uncomfortable position of the spectator of Seneca's despairing plays.

Senecan Drama after the Classical Period

The fortunes of Senecan drama have crested twice: once during the Elizabethan period, and again in our own day. Although Seneca himself never refers to his tragedies, they were known in antiquity at least until Boethius (ca. 480–524 CE), whose *Consolation of Philosophy* draws on the themes of Seneca's choral odes. The dramas then largely dropped from sight, to reemerge in 1300 in a popular edition and commentary by Nicholas Trevet, a Dominican scholar at Oxford. Trevet's work was followed by vernacular translations in Spain, Italy, and France over the next two centuries. In Italy, an early imitator was Albertino Mussato (1261–1329), who wrote his tragic drama *Ecerinis* to alert his fellow Paduans to the danger presented by the tyrant of Verona. In England, the Jesuit priest and poet Jasper Heywood (1535–1598) produced translations of three of the plays; these were followed by Thomas Newton's *Seneca His Tenne Tragedies Translated into English* in 1581—of which one tragedy was Newton's own *Thebais*. The dramas were considered to be no mere pale shadow of their Greek predecessors: Petrarch, Salutati, and Scaliger all held Seneca inferior to none on the classical stage. In Scaliger's influential treatise on poetry, the *Poetices libri septem* (1561), he ranks Seneca as the equal of the Greek dramatists in solemnity and superior to Euripides in elegance and polish (6.6).

The Elizabethan playwrights in particular took up Seneca as a model for translation or imitation. T. S. Eliot claimed that "No author exercised a wider or deeper influence upon the Elizabethan mind or upon the Elizabethan form of tragedy than did Seneca," and the consensus is that he was right. It is perhaps little wonder that Seneca appealed to an age in which tragedy was seen as the correct vehicle for the representation of "haughtinesse, arrogancy, ambition, pride, iniury, anger, wrath, envy, hatred, contention, warre, murther, cruelty, rapine, incest, rovings, depredations, piracyes, spoyles, robberies, rebellions, treasons, killings, hewing, stabbing, dagger-drawing, fighting, butchery, treachery, villainy, etc., and all kind of heroyicke evils whatsoever" (John Greene, *A Refutation of the Apology for Ac-*

tors, 1615, p.56). Kyd, Marlowe, Marston, and Shakespeare all read Seneca in Latin at school, and much of their drama shows his influence in one form or another. The itinerant players at Elsinore in Shakespeare's *Hamlet* famously opine that "Seneca cannot be too heavy nor Plautus too light" (2.2.400–401), but it is Shakespeare's *Titus Andronicus* that shows the greatest Senecan influence with its taste for revenge, rape, decapitation, human cookery, and insanity. Richard III and Macbeth, on the other hand, exemplify the presence of unrestrained, brooding ambition in the power-hungry protagonist. Similarly, in such plays as Thomas Kyd's *The Spanish Tragedy* and John Marston's *Antonio's Revenge* we see the influence of such Senecan fixtures as ghosts speaking from beyond the grave, graphic violence, obsession with revenge, and even structural features such as choruses, use of stichomythia, and division into five acts.

The bleak content of the dramas was often tied to the notion of a moral lesson. Already Trevet's preface to the *Thyestes* argued that the play taught the correction of morals by example, as well as simply offering the audience enjoyment. The Jesuit Martín Antonio Delrio (1551–1608) defended the use of Roman drama in a Christian education by suggesting that it provided a masked instruction in wisdom, as did Mussato before him. Nonetheless, after the middle of the seventeenth century Seneca's drama fell largely into disrepute. The Restoration poet John Dryden (1631–1700) took the opportunity in the preface to his own *Oedipus* to criticize both Seneca's and Corneille's versions; of the former, he wrote that "Seneca [. . .] is always running after pompous expression, pointed sentences, and Philosophical notions, more proper for the Study than the Stage." The French dramatist Jean Racine (1639–1699) used Seneca as a model for his *Phèdre*, but at the same time claimed that his main debt was to Euripides. Not surprisingly, the Romantics did not find much to like in Seneca. Recently, however, an efflorescence of interest in both the literary and the performance aspects of Senecan drama has produced new editions, scholarly monographs, and the staging of some of the plays. Noteworthy here are Sarah Kane's adaptation *Phaedra's Love*, performed in New York in May 1996; Michael Elliot Rutenberg's May 2005 dramatization of a post-holocaust *Oedipus* at Haifa University in Israel; and a 2007 Joanne Akalaitis production of the *Thyestes* at the Court Theater in Chicago.

A note on the translations: they are designed to be faithful to the Latin while reading idiomatically in English. The focus is on high standards of accuracy, clarity, and style in both the prose and the poetry. As such, the translations are intended to provide a basis for interpretive work rather than to convey personal interpretations. They eschew terminology that would imply a Judeo-Christian moral framework (e.g., "sin"). Where needed, notes have been supplied to explain proper names in mythology and geography.

For further information

On Seneca's life: Miriam T. Griffin, *Seneca: A Philosopher in Politics* (Oxford: 1976) and Paul Veyne, *Seneca: The Life of a Stoic*, translated from the French by David Sullivan (New York: 2003). On his philosophical thought: Brad Inwood, *Seneca: Stoic Philosophy at Rome* (Oxford: 2005), and Shadi Bartsch and David Wray, *Seneca and the Self* (Cambridge: 2009). On the dramas: A. J. Boyle, *Tragic Seneca: An Essay in the Theatrical Tradition* (New York and London: 1997); C. A. J. Littlewood, *Self-Representation and Illusion in Senecan Tragedy* (Oxford: 2004); and Thomas G. Rosenmeyer, *Senecan Drama and Stoic Cosmology* (Berkeley: 1989). On Seneca and Shakespeare: Robert S. Miola, *Shakespeare and Classical Tragedy: The Influence of Seneca* (Oxford: 1992) and Henry B. Charlton, *The Senecan Tradition in Renaissance Tragedy* (Manchester: 1946).

Abbreviations

For the titles of works by Greek and Roman authors I use the abbreviations given in S. Hornblower and A. Spawforth, eds., *The Oxford Classical Dictionary*, 3rd ed. revised (Oxford: Oxford University Press, 2003), xxix–liv. I have cited early Greek philosophers according to the standard numbering system of Hermann Diels and Walther Kranz.

CCS B. Inwood, ed. *The Cambridge Companion to the Stoics*. Cambridge: Cambridge University Press, 2003.

DK H. Diels and W. Kranz. *Fragmente der Vorsokratiker.* 6th ed. 3 vols. Zurich: Weidmann, 1951–52.

FGH F. Jacoby. *Die Fragmente der griechischen Historiker*. Berlin: Weidmann, 1923–.

FHG C. Müller. *Fragmenta Historicorum Graecorum*. 4 vols. Paris: Ambrosio Firmin-Didot, 1841–70.

LS A. A. Long and D. N. Sedley. *The Hellenistic Philosophers*. Vol. 1. *Translations of the Principal Sources, with Philosophical Commentary*. Vol. 2. *Greek and Latin Texts with Notes and Bibliography*. Cambridge: Cambridge University Press, 1987.

RE A. Pauly, G. Wissowa, and W. Kroll, eds. *Real-Encyclopädie der classischen Altertumswissenschaft*. Stuttgart: Metzler, 1894–1978.

SVF J. von Arnim. *Stoicorum Veterum Fragmenta*. 4 vols. Leipzig: Teubner, 1903–24; repr. Stuttgart: Teubner, 1964.

Translator's Introduction

The Structure and Content of the *Natural Questions*

Natural Questions is the traditional English translation of the Latin title *Naturales Quaestiones*. A better translation might be *Natural Inquiries* or *Inquiries into Nature*, but I use the traditional title here. This is the first translation to present the eight books of the *Natural Questions* in what is now widely agreed to have been the order in which Seneca originally wrote them. Analysis of the medieval manuscript tradition, in which the books are presented in various orders and numerations, and of the passages in the work that have a bearing on the book order, indicates that Seneca wrote the books in the order 3, 4a, 4b, 5, 6, 7, 1, 2, whereas in many manuscripts, and in all printed editions and earlier translations, books 1 and 2 come at the start.[1] This translation follows the original order, but I use the traditional numeration of the books to facilitate reference to other translations, editions, and scholarly literature.[2] The individual books are for the most part self-contained, with few clear cross-references between books (only between 3 and 4a, 5 and 6, and 1 and 7).[3]

The title *Natural Questions* suggests investigations of nature quite generally, and the opening of the work announces Seneca's intention to "traverse the world" and "investigate nature" without restriction (3.praef.1, 18). But the work as we have it covers a very specific range of topics. There is no extended treatment of cosmology, or astronomy, or biology, for example, all of which might be expected in a work on nature (they are treated in the elder Pliny's *Natural History*, written not many years after Seneca's death). We may summarize the topics covered by the *Natural Questions* as follows (for a more detailed analysis of the contents of each book see below):

Book 3	Rivers
Book 4a	The Nile River
Book 4b	Clouds, rain,[4] hail, snow
Book 5	Winds
Book 6	Earthquakes

Book 7	Comets
Book 1	Meteors, rainbows, and other optical meteorological phenomena
Book 2	Lightning and thunder

We know that parts of books 4a and 4b have been lost (see n. 1). Nothing at the end of book 2 expressly indicates that it is the conclusion of the work, so it is possible that Seneca wrote further books that have not survived, or that he intended to write more books but left the work unfinished at his death; however, we have no evidence of this.

Ancient Meteorology

Today's reader will be struck by the range of modern disciplines that Seneca touches on—geography, meteorology, seismology, and astronomy—but the ancient reader would have seen that his work deals with what the Greeks called *meteorologia*, "meteorology." Ancient meteorology covered a much broader field than its modern counterpart. So far as we know, Aristotle had first identified meteorology as a separate branch of knowledge, distinct from astronomy, in his *Meteorologica*. In this work he deals with events occurring in the atmosphere, including clouds, rain, snow, hail, thunder and lighting, rainbows, and other optical phenomena, all of them topics covered in modern meteorology and meteorological optics; but he also discusses meteors and comets, which, he argues, originate and persist in the atmosphere (though today we know that comets orbit in space, and meteors appear when objects enter the earth's atmosphere from space); and he also includes the sea, rivers, and earthquakes, because, even though they do not occur in the atmosphere, in his view they are caused by the same physical forces that operate in the atmosphere.

The *Natural Questions* and Stoic Physics

Although the topics that are covered in detail in the *Natural Questions* fall within the scope of ancient meteorology, the title suggests investigations of nature quite generally. Furthermore, throughout the work Seneca's discussions are conducted within the framework of Stoic physics. He assumes that the world is controlled by a rational deity, who can be identified with reason, nature, providence, and fate

(see, e.g., 2.45).[5] There are no chance or random events in the world, for everything is controlled by the divinely ordained chain of cause and effect (see, e.g., 1.praef.14; 2.45.2). Everything, including god, is corporeal, and matter is continuous, with no void within the world. The whole world is composed of the four elements—earth, water, air, and fire—which are constantly interacting and changing into one another. But also—and this is a distinctively Stoic doctrine—the energy that gives everything its coherence and its vitality, its ability to move and change, comes from what in Greek is called *pneuma*, in Latin *spiritus*, which is here translated as "breath."[6] "Breath" in Stoicism is not another element, but a combination of air and fire, and it possesses "tension," which gives coherence and dynamism to everything in the world, animate or inanimate, as Seneca explains in detail in 2.6–11.[7] The attribution of breath to inanimate objects, and also to the whole cosmos, is one aspect of the correspondences that exist between microcosm and macrocosm, between the human body, and the body of the earth, and the body of the world—correspondences that Seneca exploits (see, e.g., 3.15; 6.14; 1.praef.15). In fact in Stoicism the earth is a living creature, and the whole world is a living creature with a soul.[8] Seneca also presupposes the main tenets of Stoic ethics, that the best life is one lived according to nature, or reason, or virtue.

Such doctrines are rarely discussed at length, except in the last two books, for in the preface to book 1 he speaks about Stoic theology, and in book 2 he discusses the nature of air and breath (2.2–11) and problems connected with divination (2.32–51). In addition, he discusses a number of specific ethical issues throughout the work, all of them hinging on right and wrong attitudes to nature (see further below). The constant presence of Stoic physics in the background and these extended discussions of specific issues give substance to his claim that this is a work about nature generally, not just a textbook on meteorology.

Seneca's Knowledge of Earlier Meteorological Writing

Nevertheless, each of the surviving books of the *Natural Questions* is devoted to a problem or problems that fell within the scope of ancient meteorology. Meteorological phenomena had been discussed by philosophers before Aristotle, even if they did not demarcate meteorology as a separate discipline. None of their works survives

complete, but there are numerous reports of their ideas from later writers, including Seneca himself. Aristotle had many successors in the field. His pupil Theophrastus was one of the earliest of them. His Greek work on meteorology did not survive, but in the twentieth century extensive Syriac and Arabic versions were discovered. Epicurus, the founder of the Epicurean school, wrote on the subject, and a substantial summary of his views survives. Posidonius, the leading Stoic philosopher of the first century BCE also wrote on meteorology. In Latin, the philosophical poem of Lucretius contains detailed discussions of meteorological phenomena, following Epicurus in its ideas though not in its poetic format. Seneca's work is the longest and most detailed meteorological work surviving from the period after Aristotle. Not long after Seneca, Pliny the Elder dealt with meteorological topics in book 2 of his surviving *Natural History*, and from late antiquity there survive Greek commentaries on Aristotle's *Meteorology*, as well as other briefer treatments in Greek.[9]

Seneca's predecessors regularly appear by name in his work, but they do not all get the same amount of coverage. The Presocratics feature fairly frequently, though no single philosopher appears more than half a dozen times. Aristotle is mentioned quite often, and his followers Theophrastus and Strato a few times. The Epicureans, however, are rarely on view: Epicurus is mentioned only once (6.20.5), and Lucretius is quoted once without being named (4b.3.4). However, the atomic theory of matter is criticized in some detail (2.6–7), and there is passing criticism of the view that the whole world is the product of chance (1.praef.15), but all without the Epicureans needing to be named. There is an interesting contrast with Seneca's *Letters*, where the *moral* teachings of Epicurus, or at least carefully selected aspects of them that are acceptable to Seneca, receive considerable prominence in the earlier part of the collection. But despite the rarity of explicit references to Epicurus or Lucretius, the work shares important characteristics with Lucretius's poem: like Lucretius, Seneca offers a rational explanation of events that were often attributed to the action of malevolent or arbitrary gods, and he offers freedom from fear of the frightening aspects of nature (see further discussion below). But Seneca is a Stoic, and it is possible to see his work, with its vision of the world under the control of a rational deity, not

governed by blind chance, as, among other things, a Stoic riposte to Lucretius's Epicurean vision of the world.

As we have seen in the preceding section, Seneca's worldview is Stoic. When it comes to the details of meteorological theory, Posidonius receives a number of mentions, and his pupil Asclepiodotus a few; but of the earlier Stoics, only Zeno is mentioned, just once, by name (7.19.1). On the other hand, there are some references to the Stoics collectively, though they are always referred to as "our people" (*nostri*), not "Stoics." Sometimes people are mentioned who are not known to have belonged to the main philosophical schools, and in book 7 in particular considerable prominence is given to three men who are virtually unknown outside the writings of Seneca, Apollonius of Myndus, Artemidorus, and Epigenes.

In the late nineteenth and early twentieth centuries there was much debate about the sources of the *Natural Questions*: which earlier works did Seneca rely on? The answer then given was often that he relied heavily on a single lost Greek work on meteorology, which was either by Posidonius or was a later work summarizing Posidonius's ideas. In the later twentieth century, scholars were readier to allow that Seneca's reading on the subject was most probably broader, and his own acquaintance with the field rather more assured, than the earlier scholars had allowed, and that there was no need to think he was following a single source closely. Definitive conclusions will never be reached because of the loss of most of the original works of writers to whom Seneca referred. In the case of Aristotle, we are in the unique position of being able to set the original work alongside Seneca's reports of his ideas, yet even so scholars reach different conclusions. It is clear that Seneca often gives a summary version of a longer treatment by Aristotle, and that the summaries are often loose, sometimes inadequate or distorted. On the other hand, occasionally Seneca's Latin seems to follow Aristotle's wording pretty closely. These characteristics are largely agreed upon, but scholars disagree about how to explain them: for some, they demonstrate that Seneca could not have read Aristotle's original text but must have read a later report of his views; but others allow that Seneca may well have had access to a text of Aristotle, but did not use and report it as carefully as a modern scholar would be expected to. Similar

problems arise with other Latin writers. We know that this was not Seneca's first work on a meteorological topic, for he refers to a work on earthquakes that he had written in his early years (6.4.2), and we know from elsewhere of other works on scientific topics that do not survive. So he is likely to have had a good general knowledge of ancient science, though naturally he is likely to have read or reread particular works when writing the *Natural Questions*.[10]

Critical Doxography

Seneca includes a lot of information about the views of earlier writers and engages critically with their ideas. Writers on meteorology did not always do this. Epicurus and Lucretius never, or hardly ever, discussed the ideas of their predecessors on meteorology. On the other hand there were works—called *doxographical* works—that did no more than offer bald summaries of the views of a range of earlier writers. But Seneca engages in critical doxography, not just describing, but also criticizing the ideas of his predecessors, as part of the process of arriving at his own views. The method goes back to Aristotle, and had very likely been used by Posidonius as well.[11] Argument about rival explanations is vital to Seneca's work. He is not, however, writing a history of the subject: the order in which philosophers appear is not chronological but usually follows the dynamics of the argument; and theories are regularly presented anonymously. Book 6 is a good example, where the discussion of the causes of earthquakes begins at 6.5.1 by saying that people have explained earthquakes as caused by water, or fire, or earth, or air, or more than one of these, or all of them. The discussion that follows keeps to that order of topics, with the holders of particular views sometimes being named, but not always.

Another characteristic of Seneca's argumentative exposition is that he sometimes keeps his cards to his chest and reveals his own opinion only at a later stage of the book. It can be disconcerting when, early on, he criticizes a view that he will later advocate himself, or defends a view that he will later repudiate. For example, in book 7 on comets, the view of Apollonius of Myndus that comets are planets is introduced at 7.4.1, described in more detail in 7.17, and then criticized in 7.18. But the view that Seneca later advocates in 7.24–27 has strong similarities to that of Apollonius, and he there answers some

of the objections he had earlier made to Apollonius's theory. On the other hand, in 7.21.2–4 he defends the Stoic view of comets against various objections, but then at 7.22.1 tells us that he rejects that view. He is clearly trying to tease out the strengths and weaknesses of each theory with a degree of impartiality, instead of making his own views clear at the outset.

Methodology

Should the *Natural Questions* be described as scientific? Should any work of ancient meteorology be described in that way? Few of the explanations of phenomena accepted by Seneca bear much resemblance to the modern scientific explanations. The main exception is in book 7 on comets, where he rejects the well-entrenched view of Aristotle and Posidonius, among others, that they are temporary atmospheric phenomena, and argues that they are celestial bodies like planets, though their orbits are as yet not understood. Significantly, it is in the book that comes closest to astronomy that Seneca is most accurate, for in the case of comets, naked-eye observation could achieve some progress. But with most of the topics Seneca discusses, naked-eye observation was never going to achieve much. True, if expeditions had succeeded in reaching the sources of the Blue and White Nile and studied the climate there, the causes of the Nile's flooding could have been better understood. But there was no way that observation of thunderclouds from the ground would reveal the electrical properties of lightning, or that observation of the visible effects of earthquakes would lead directly to plate tectonics. Even the most basic concepts of modern meteorology were lacking, or extremely vague and totally unquantifiable. Notions of air pressure were confined to the idea of the pressure exerted by air or wind in motion, which is rather different from the modern meteorologist's understanding of air pressure; and there were no barometers. When talking about heat and cold, ancient writers did not distinguish as a modern physicist would between heat energy and temperature, and there were no objective means of measuring temperature. As noted above, Seneca, like most ancient scientific writers, takes for granted the theory of four elements—fire, air, water, earth. They can all change into each other, but there are no precise rules governing when and how they can do so, and no experiments to test hypotheses about how

such changes occur. Nevertheless, Seneca and other ancient writers on meteorology were performing a service to later science in their restless exploration of the linguistic and logical possibilities of key terms like *element*, *hot*, *cold*, *dense*, and *rarefied* by laying conceptual groundwork for a time in the distant future when experiments could clarify such concepts and measure such properties.

On the other hand, what Seneca does is akin to science in that he seeks explanations in purely physical terms, without any divine intervention at the local level (and at the cosmic level, divine activity follows its own regular laws; e.g., see 1.praef.3). He employs observation in his arguments and sometimes recognizes the necessity of collecting data over a long period of time (7.3.1). And, as we shall see, he recognizes that progress comes only from a painstakingly long, collaborative effort by generations of scholars.

At the heart of Seneca's arguments and explanations lies analogy. The use of analogy in meteorology had a long history, going back to the Presocratics. Seneca does not merely use analogy, but is self-conscious and reflective about it, recognizing that it yields only a possible explanation, not a certain one (see 2.22–23). By contrast, geometry can give "arguments that are not just persuasive but compelling" about the formation of the rainbow (1.4.1). Seneca does not give us these geometrical proofs—he sticks to less taxing types of argument—but the assumption is that geometry can give a level of proof that is not available to the arguments and analogies that Seneca normally uses, which are persuasive rather than compelling.

Debate is a primary vehicle of persuasion, and much of the argument of the *Natural Questions* takes the form of debate with earlier thinkers and earlier theories. A good example of sustained debate is the discussion of the rainbow in 1.3–8. The debates in the *Natural Questions* repeatedly come back to the evidence of the senses and of experience. There are dozens of references to what can be seen and occasional references to what can be heard, smelled, tasted, and touched (e.g., 3.2; 3.24–25; 2.21.2; 2.27). Yet at the same time Seneca regularly stresses the unreliability of the senses. It is not just that different people report differently on the same phenomenon (see 7.11.3; 1.3.7–8), or that some things are too small to be seen at all (4b.9; 6.24.1; 7.30.4), but in some circumstances we are all equally prone to be misled by what we can see. He refers to well-known optical illu-

sions (1.3.9–10; 1.6.5; 1.14.3; 1.17.1) and to the weakness of our sight and other senses (3.25.1; 3.28.5; 1.15.6–8). The remedy for the weaknesses of our senses is to use our reason as well, a lesson that Seneca sometimes spells out (6.3.2; 6.7.5) and constantly exemplifies in the ceaseless probing of his arguments, which display reason in action. In addition, there are some things that are in principle inaccessible to our senses and available only to reason, notably knowledge of god, which can be achieved through study of the natural world (7.30.3; 1.praef.).

The Community of Scholars

Seneca's practice exemplifies his conviction that progress can best be made by critical dialogue with the thinkers of the past. He has a clear vision of meteorology as a collaborative effort by numerous investigators over many centuries, a process that will continue far into the future. Progress depends on the patient collection of information about the phenomena in question and on critical probing of the theories of one's predecessors. He warns against dismissing the theories of the earliest thinkers as crude or silly, because they took the essential first steps, and later thinkers were building on their efforts (6.5.2–3). And just as their ideas seemed antiquated by Seneca's day, so Seneca is sure that his ideas will seem just as antiquated to people far in the future (7.25.4–7; 7.30.5).[12] Here is an implicit signal to us later readers to be as critical of his ideas as he is of the ideas of his predecessors.

In effect Seneca pictures a community of scholars stretching across time and across national and philosophical boundaries. Most of the thinkers he mentions are Greeks, but there are occasionally Egyptians, Chaldaeans, and Romans too, and all are treated on the merits of their ideas. We have already seen the range of philosophers he refers to, and he shows no favoritism to his own Stoic school; in fact some of his most stinging criticism targets fellow Stoics (e.g., 4b.3.1–2; 4b.6–7). But although he looks far into the past and into the future, there is little trace in the work of a contemporary intellectual context. Occasionally he does give information from contemporary informants: Balbillus, prefect of Egypt, provides a story about a battle between crocodiles and dolphins (4a.2.13–15); we hear about the experiences of an unnamed man during the recent Campanian earthquake (6.31.3); and some scholars have argued that the Apollonius

of Myndus who appears in Book 7 was a contemporary of Seneca's. But this is not certain, and at the end of the book we find Seneca lamenting the current neglect of philosophy in a society that is more interested in dancers and mime-actors (7.31–32).

The Contemporary Context

The *Natural Questions* can be firmly dated to the early 60s CE. References to Nero as emperor (see below) show that the *Natural Questions* was written after Nero's accession (54 CE), and references to a recent earthquake and comet in books 6 and 7 help date the book to the early 60s, in the last years of Seneca's life.[13] Tacitus describes how Seneca effectively withdrew from Nero's court in 62, after the death of Burrus (*Ann.* 14.52–56). We cannot be certain that he began the *Natural Questions* after, rather than before, this withdrawal, but the preface to book 3, with its talk of his old age, of "having used up my years in fruitless pursuits" and "the losses of a misspent life," seems obliquely to express regrets about his political career. At various points he seems to distance himself from the Roman political world—notably in his denunciation of writing history (3.praef.5–6) and in his disparagement of military conquests and imperial power (3.praef.9–10; 5.18.12; 1.praef.8–10)—all within the context of his appeal to the reader to seek understanding of the entire cosmos in all its splendor, compared to which the earth and earthly achievements are insignificant (1.praef).

But at the same time, Seneca cannot escape the gravitational pull of his Roman context. One contemporary who features prominently in the work is its dedicatee, Lucilius, who is also the dedicatee of the dialogue *On Providence* (*Dial.* 1) and of the *Letters*. In Letter 79 Seneca asks him to investigate certain questions about Charybdis and Etna, but there is no suggestion in the *Natural Questions* that Lucilius is interested in pursuing scientific questions for himself. What we do hear about is his past career and his current post, a procuratorship in Sicily; yet Seneca's message in the preface to book 4a is that Lucilius must resist the dangers of his social and political environment, where flattery is rife, and he offers the discussion of the Nile as a means of drawing him away from Sicily.

Another contemporary who is mentioned more than once is the emperor Nero. A line of his poetry is quoted approvingly (1.5.6), and

his principate is referred to in passing as "most fortunate" (7.21.3). In book 6 he appears as a sponsor of geographical and scientific investigation when Seneca says that he sent two centurions to search for the sources of the Nile (6.8.3–5). They remained unknown to the Greeks and Romans, which hampered attempts to explain the river's annual flooding, the topic of book 4a. Other ancient writers speak of military motives for Nero's expedition, but there is no reason to doubt that geographical exploration was one motive. In the passage Seneca describes Nero as "[a] great lover of truth." This is sometimes taken to be conventional flattery, even ironic, but it may well be that Nero, like other ancient rulers, took steps to promote various kinds of intellectual activity, though any such efforts hardly register in the hostile ancient historical tradition.[14]

In Rome, natural events could assume immense political significance. The appearance of a comet in 60 CE was one example, for comets were widely believed to portend the death of a ruler. It was rumored that Nero would be succeeded by Rubellius Plautus, so Nero asked him to move to Asia to quell the rumors (*Ann.* 14.22). Seneca refers to this comet as one that "did away with the ill repute of comets" (7.17.2). But there were serious philosophical issues at stake: the *Natural Questions* refers to the debate about whether comets, ominous lightning strikes, and so on are divinely sent signs indicating the displeasure of the gods or ordinary natural events with the same sorts of causes as other events (see, e.g., 2.32.2–4). Seneca strongly advocates the second view. But we know that other views about comets were available in Rome in the 60s, so that Seneca's treatment of the topic, which resolutely treats them as ordinary—and in principle predictable—natural phenomena, has political implications.

More generally, much of the *Natural Questions* is about phenomena that featured prominently in the Roman religious system, with its careful attention to signs and omens sent by the gods. Lightning that caused death or destruction, earthquakes, and unfamiliar bright objects in the sky, as well as comets, were traditionally regarded as portents or prodigies, that is, as signs of the gods' displeasure, and there were traditional forms of religious expiation. But Seneca puts forward natural explanations of these events, just as Lucretius had done before him from an Epicurean standpoint. By contrast, it may seem that in book 2 Seneca does adopt the traditional religious ap-

proach, when he has a long discussion of divination from thunder and lightning (2.32–51). But throughout this discussion he follows the orthodox Stoic line that while such phenomena can indeed predict future events, this is not because any god directly causes the phenomenon; rather, the predictive power is the result of a chain of natural cause and effect linking the phenomenon and the consequence. One might say that, for Seneca and the Stoics, divination from lightning was in principle no different from, and just as scientific as, weather forecasting; though they acknowledged that they were both as yet very inexact sciences.[15]

The Ethical and Religious Context of Science

The traditional Roman ways of dealing with portents and prodigies can be seen, at least in part, as a means of handling the public anxiety that was often occasioned by unfamiliar events such as the appearance of a comet or damage to a temple by lightning. One may therefore see Seneca as offering a philosophical alternative to the traditional religious means of handling such anxieties. At certain points in the *Natural Questions* he directly addresses the fears that people have of earthquakes or lightning, and in this he follows a long philosophical tradition. Epicurus had gone so far as to say that one needs to study the physics of the world only in order to remove the fear of death and the fear of the gods; Lucretius follows him in preaching freedom from fear; and that is one of the motifs running through Seneca's work.

Scholars have debated whether the ethical lessons derived from science are the main motivation of the *Natural Questions*. The debate starts from the fact that, though the work is on meteorology, the majority of the books contain prefaces, conclusions, or digressions on topics that ostensibly have nothing to do with meteorology. Some of these, as just mentioned, tackle human fear of unfamiliar phenomena (6.32; 2.59). Some tackle then fashionable forms of luxurious and decadent living that abuse the gifts provided by nature: the craze for cooling drinks with snow (4b.13); the use of winds for sea-travel not to increase knowledge but to wage war (5.18); the use of mirrors by a man whose sexual antics were notorious (1.16); and the contemporary insistence on watching fish die at the dinner table before eating them (3.18). Some tackle broader scientific and philosophical issues

(7.30–32; 1.praef; 2.1–10). These sections of the work have been viewed in different ways: as interludes extraneous to the main scientific material, more accessible and entertaining than the technical arguments, and used like sugar to help the scientific medicine go down; or as the real point of the work, with the scientific sections there only to support the moral and religious inferences. But either of these views taken to extremes is unnecessarily reductive.

Sometimes within the work itself voices are raised questioning the value of technical scientific discussions, and sometimes Seneca stresses that scientific understanding will produce moral benefit (e.g., 3.praef.18; 4b.13.1; 6.4.2; 6.32.1; 2.59.2). Here he is following a strong philosophical tradition that sees ethics as ultimately more important for human beings than physics, and he is also addressing traditional Roman doubts about the usefulness of theoretical philosophy. But such passages should not be taken as a key to unlocking the whole structure and purpose of the *Natural Questions*, as though the only reason for all this scientific discussion is the moral lessons to be drawn from it. It is clear enough that for Seneca there are other motivations: apart from the intrinsic interest of the natural world, he repeats the theme of wonder at the beauty of the world (see especially 6.4.2) and the assurance that study of the world will lead to the ultimate goal—knowledge of the divine ordering of the world and of god himself (1.praef.).

Mastery of the World

The preface to book 1 outlines Seneca's ideal of the virtuous person who relies not only on sight but on the proper use of reason and thus attains to knowledge of god and of the entire world. Hostius Quadra, whom Seneca castigates at the end of the book for performing his versatile sexual acts surrounded by magnifying mirrors, is the antithesis of this virtuous person; among other faults, he is too attached to what his eyes can see (1.16.3–4). So too are the diners who demand to watch a fish dying on the table before they will eat it (3.18.7). Such people, in Seneca's descriptions, are just as single-minded as the philosopher, but they never go beyond what their eyes can tell them. Then there are the people whom Philip of Macedon sent underground to explore old mine workings and see if there was anything left: they may be investigating parts of the physical world that the

eye cannot immediately see, but their motives are completely wrong, being focused on the hoped-for wealth beneath their feet rather than on the heavens above (5.15). There are different ways of seeking to master the physical world: these people exploit its resources and seek to master it for the sake of their own pleasure and greed, while the philosopher seeks reverently to understand the natural world and the deity who controls it (7.30). Seneca contrasts the vigorous pursuit of immoral pleasures by his contemporaries with their complete neglect of philosophy (7.31–32).[16]

There is another way of seeking to master the world that is antithetical to the philosopher's, and that is military and political mastery. The preface to book 1 speaks disparagingly of the insignificance of earthly empires when they are compared with the immensity of the heavens. At the end of book 5 the misuse of the winds to send fleets off in search of conquests and wars is contrasted with the use of the winds to travel in search of new knowledge of the world (5.18). This implies a rather negative view of Roman imperialism, but Seneca's main concern is to emphasize the difference between understanding and controlling the world for the sake of power or pleasure, and the desire to understand it out of philosophical motives.

The *Natural Questions* as a Work of Literature

There were many different forms of writing about scientific topics in the ancient world, including technical treatises written for the expert or professional, literary dialogues, letters, doxographical works cataloguing the views of earlier writers, and didactic poems. Seneca's prose treatise contains a good deal of detailed and intricate argument, but at the same time, just as in all his philosophical works, he uses all his literary skill to create something that will be lively and enjoyable to read, and the result is very different from the average modern scientific textbook. There are passages of dense argument and detailed lists and classifications of phenomena, but there also are passages of vivid description of nature's power; there are scathing, satirical denunciations of contemporary lifestyles, along with exhortations to face death without fear and to take seriously the kind of philosophy that Seneca is offering.[17]

The relative independence of the individual books has already been mentioned, but each book is a carefully crafted unity.[18] The

patterning of introductions, interludes, and conclusions is carefully done, and even when the transitions seem at first arbitrary, we can find subtle links. The last two books to be written show a kind of ring-compositional architecture that is more usually associated with poetic works: in book 1 the chapters on optical meteorological phenomena (2–13) are framed by two discussions of meteors (1, 14–15); in book 2 a long central discussion of divination (32–51) is framed by two sections on the marvelous effects of lightning (31, 52–53), and by scientific discussions that move deliberately from doxographical discussion to presentation of Seneca's own views (see the analytical table of contents below).

The scientific sections are enlivened in all sorts of ways. Terse, economical phrasing, sharp antitheses, and vivid imagery are deployed throughout. Seneca addresses the reader directly, sometimes asking questions or giving orders (e.g., 3.16.4; 5.14.2; 6.24.6). He makes periodic use of the trope by which the theorist himself appears to be "doing" what he actually describes as happening in nature; for instance, at 2.7.1: "Some people tear air apart and divide it into particles, mixing void with it" (referring to atomists). He is fond of saying the same thing twice, even three times, in a slightly different way (e.g., 2.9.4; 6.1.4; more extensively, 4b.11)—so fond that he once explains (not altogether convincingly) that this is not just stylistic showmanship but reinforcement of an essential point (2.21.4). We have already seen that the scientific discussion regularly takes the form of a vigorous debate between Seneca and other thinkers. This is sometimes described in the language of Roman legal procedure (e.g., 4b.4.1; 4b.5.1; 2.46) or senatorial procedure (e.g., 3.15.1; 6.19.1), which draws attention not only to the adversarial texture of the *Natural Questions*, but also to its aspirations to impartial fairness; at the same time, such language may appeal to the Roman reader. Sometimes the reader may get the distinct impression that Seneca is thinking out loud, speculating "on the hoof," as it were (e.g., 5.13.4; 2.39.2–4; 2.53.1); but of course this may be a carefully contrived impression—and another lesson in thinking for ourselves.

Quotations from the poets are frequent in the *Natural Questions*, the majority from Virgil and Ovid. The quotations vary the literary texture, but they are often there to illustrate a scientific point as well, for ancient poets were expected to know about the workings

of the physical world. By the same token, they could be criticized for getting it wrong. Seneca ticks Virgil off in passing for making more than one wind blow at once (5.16.2); this is tongue-in-cheek, for poets were allowed to exaggerate. But he is more serious in his criticisms of Ovid's lack of decorum in his description of the great flood (3.27.13–15).

Some Features of Seneca's Worldview and Scientific Terminology

Seneca takes for granted certain features of the physical world and uses certain terms to describe it that were commonplace in his own day but may be unfamiliar to the modern reader. Some concepts of Stoic physics have already been described above. Seneca takes for granted that the cosmos is spherical, with the spherical earth stationary at the center, and the moon, sun, planets, and fixed stars rotating round it. They rotate at different speeds: the speeds of the moon, sun, and fixed stars are constant (though slightly different from each other), whereas the planets slightly vary their speed and their direction, sometimes accelerating, slowing down, going into reverse, or veering sideways in relation to the background of fixed stars. (In Greek the word *planet* meant "wandering.") The earth is at the center, but Seneca also describes it as being at the bottom of the cosmos, because heavy things all sink towards it, and the lightest materials rise to the highest part of the cosmos, its outer sphere of the fixed stars. The fire of the stars and planets is fed by vapors or exhalations that constantly rise from the surface of the earth. Seneca accepts that human vision involves rays going out from the eye to the seen object.

Modern English has a quite clear distinction between *planet*, *star*, and *constellation*, but Seneca's Latin terminology does not (even though he makes a clear distinction between planetary and stellar motion): there are two words (*sidus* and *stella*), but each could be used in any of these senses. Seneca can add an adjective, "wandering" or "erratic," to make it clear that he is referring to a planet, but without such an epithet, the sense of the words is often indeterminate or ambiguous. In book 1 Seneca refers to phenomena of reflection and of refraction, but his terminology makes no systematic distinction between the two, nor does his argument, so I sometimes avoid the

terms *reflect* and *refract* in the translation in favor of more neutral (though less natural) phrases like *bend back*. Sometimes Latin is capable of greater precision than English: in book 3 on rivers, Seneca can exploit the difference between *amnis*, which is normally a very large, grand river, and *flumen* and *fluuius*, which normally denote rivers of more average size; but while English has various words for smaller streams, it has no word like *amnis* to denote a large river.

The Text of the *Natural Questions*

The text of our work is less well preserved than that of most of Seneca's other works. The earliest surviving manuscripts of the *Natural Questions* date from the twelfth century (though there are some brief excerpts of earlier date), and their text is frequently corrupt, so that it is sometimes uncertain exactly what Seneca wrote. In the translation, the following typographic signs are used to indicate some of the major problems and uncertainties:

< > Angle brackets enclose the translation of Latin words that are not in the manuscripts but are added by the editor (but minor supplements that are uncontroversial or do not substantially affect the sense are ignored).

[ ] Square brackets enclose the translation of Latin words that are in the manuscripts but are regarded as later interpolations, not Seneca's own words.

*** Asterisks within angle brackets indicate that something is missing from the manuscripts, but no supplement is offered in the translation. Asterisks without brackets indicate that the Latin is badly corrupt and I have left it untranslated.

I have usually translated the text of my Teubner edition (1996), except that I translate a different text at the places listed below. In most cases the differences consist in adopting a supplement or conjecture that is less than certain but at least gives plausible and intelligible sense.

1.3.8: The direct speech is ended after *atque continuae* instead of *aciem repellendam*.

1.6.3: *subito* <*nascatur*, *et subito*> *desinat*, *cum omnes fulgores* <*et paulatim fiant*>.

1.6.6: *iam* <*paene*> *eius naturae est*.
2.2.4: *quorsus istud*.
2.12.5: *nec* <*extingui nec*>.
2.23.2: *sit et* (in place of *†his†*).[19]
2.24.1: *aut* <*falsum est hoc aut*>.
2.35.1: <*risu*> *excipiunt*.
2.50.1: <*quaedam significant id quod ad nos non pertinet*,>.
2.51: *eidem homini* <*idem*>.
2.53.2: *adflata* <*uitiantur*>.
2.59.4: *alia uarie fortuna disponit*.
2.59.7; *peteret* <*ut praeberet*>.
2.59.11: *extimescis*.
3.16.4: *sunt ingentes[que]*.
3.18.3: *ipse oportet mihi credam*.
3.19.4: <*alii aliquatenus in aperto fluunt*,>.
Ibid.: *sicut fluminum fontes*.
3.20.5: *[et] habens*.
3.25.10: <*ora*>.
3.27.2: *†his†* is omitted.
3.27.5: *iam nec gramina aut pabula laeta* <*laxatum*> *aquis sustinet*.
5.13.3: *et* (in place of *†haec†*).
5.18.2: *niues* is a misprint for *nubes*.
6.1.5: *agit*, *et* (instead of *agitat*,; see N. Holmes, *Classical Quarterly* 54, no. 1 [2004]: 311–12).
6.2.9: The direct speech is ended after *orbe concusso* instead of *uidere mortalem*.
6.7.6: *redundare* (in place of *†reicere†*).
6.9.1: *et* <*ii*> *quidem non* <*indocti*>.
6.12.1: *inquisitor*.
6.13.3: <*frigido autem aeri qui iam sub terra collectus est*> *hic calidus* (in place of *†huic alius†*).
7.1.3: <*nisi adiacentem*>.
7.11.2: *forma eis non est una*, <*sed eiusdem notae sunt*>.
7.14.4: *in alias incident*.
7.27.1: *exhibeat* (in place of *†accipiat†*).

Analytical Table of Contents of Individual Books

This table follows the original order in which the books were composed, but with the traditional numbering (see above).

BOOK 3: ON TERRESTRIAL WATERS

Praef.	Introduction: The importance of studying the physical world.
1–3	Announcement of topic: where rivers come from; the varied properties of water.
4–5	Why rivers do not raise the sea level.
6–7	Rain as a cause of rivers.
8–10	Underground water as a cause of rivers.
11	Why some rivers dry up periodically.
12–13	Water is one of the four elements, so in plentiful supply.
14	Other theories.
15	The earth has veins and arteries like the human body.
16.1–3	Periodic springs and rivers.
16.4–5	Underground caves with living creatures.
17–18	Moral excursus: the craze for watching mullets die at the dining table.
19	Underground fish and underground rivers.
20	The causes of different flavors of water.
21	Lethal exhalations from caves.
22	Primeval water and recently formed water.
24	Hot springs.
25–26	Various unusual properties of springs and rivers.
27–30	Epilogue: the great flood that periodically destroys the earth and purifies humankind.

BOOK 4A: ON THE NILE

Praef.	Advice to Lucilius on combating flattery.
1	The puzzle of the Nile's source and its annual flooding.
2.1–16	Description of the known course of the Nile.
2.17–30	Different theories of the flooding of the Nile (Thales, Euthymenes, Oenopides, Diogenes of Apollonia).[20]

BOOK 4B ON CLOUDS, <RAIN, HAIL, SNOW>[21]

3–5	The formation of hail.
6–7	The prediction of hailstorms.
8–12	Factors that determine whether snow or hail is formed.
13	Epilogue: the misuse of snow to produce ever-colder drinks.

BOOK 5: ON WINDS

1	Definitions of wind.
2–6	Causes of wind.
7	Pre-dawn breezes.
8–11	Coastal breezes.
10	The etesian winds.
12	Winds from a cloud.
13	Whirlwinds.
14	Winds are produced from underground caves.
15	Excursus: Asclepiodotus's story of people sent underground by Philip of Macedon.
16–17.4	The twelve principal winds.
17.5	Local winds.
18	Epilogue: nature's gift of winds has been abused by humans.

BOOK 6: ON EARTHQUAKES

1–4	Introduction: the recent Campanian earthquake. The need to free people from fear of earthquakes by enabling them to understand them.
5	Earthquakes have variously been thought to be caused by water, fire, earth, air, or a combination.
6–8	Water as cause.
9	Fire as cause.
10	Earth as cause.
11	Fire as cause.
12–19	Air as cause.
20–21.1	All four elements as causes, but chiefly air.
21.2–25	Different kinds of earthquakes and their causes.
26	Earthquakes can occur everywhere.

27–31 Explanations of unusual events associated with the Campanian earthquake.
32 Epilogue: how to be free from fear of earthquakes.

BOOK 7: ON COMETS

1 Introduction: rare phenomena like comets attract more attention than regular phenomena.
2 Questions concerning comets.
3–4.1 Brief history of the study of comets.
4.2–10 Epigenes' theory: comets form in the atmosphere.
11 Properties of comets.
12 The theory that comets are the conjunction of two planets.
13–16 Artemidorus's theory: comets are the conjunction of two planets, many of them unknown.
17–18 Apollonius of Myndus's theory: comets are unknown planets.
19–21 Stoic theories: comets form in the atmosphere.
22–29 Arguments that comets are akin to planets.
30 Epilogue: the need for reverence when investigating nature.
31–32 Contemporary neglect of philosophy and pursuit of luxury and vice.

BOOK 1: ON . . . FIRES

Praef. Introduction: the highest form of philosophy is the study of god and the cosmos.
1 Meteors.
2 Coronae.
3–8 Rainbows.
9–10 Rods.
11–13 Parhelia.
14–15 Meteors.
16 Epilogue: Hostius Quadra and the misuse of mirrors.
17 The proper uses of mirrors.

BOOK 2: ON LIGHTNING AND THUNDER

1 Introduction: the branches of physical science: astronomy, meteorology and earth sciences.

2–11	The properties of air.
12–20	Thunder, lightning-flash and lightning-bolt: review of earlier theories.
20–26	The theory accepted by Seneca.
27–29	Different kinds of thunder.
30	Formation of thunder and lightning from dry clouds.
31	Marvelous effects of lightning.
32–51	Divination from lightning: comparison of the Etruscan and Stoic views.
52–53	Marvelous effects of lightning.
54–56	Review of earlier theories of thunder and lightning.
57–58	The theory accepted by Seneca.
59	Epilogue: Removing the fear of lightning.

Natural Questions

<*On Terrestrial Waters*>

(praef.1) I am not unaware, Lucilius, excellent man, of how great is the enterprise whose foundations I am laying in my old age, now that I have decided to traverse the world, to seek out its causes and secrets, and to present them for others to learn about. When shall I investigate things so numerous, gather together things so scattered, examine things so inaccessible? (2) Old age is at my back and accuses me of having used up my years in fruitless pursuits. Let us press on all the more, and let hard work repair the losses of a misspent life. Let night be added to day, let business affairs be cut back, let there be no more anxiety about family estates situated far from their owner, let the mind have time entirely to itself, let it turn to contemplation of itself, at least in its final stages. (3) It will do so, it will drive itself on, and each day it will measure the short time left; whatever has been lost, it will recover by using its present life with care. One can rely on the transition from remorse to honorable action.

So I want to shout out these lines by the eminent poet:[1]

> We raise our mighty spirits and in a brief time
> attempt the greatest deeds.

I would say this if I were embarking on the project as a boy or young man (for any length of time would be too limited for such a great enterprise); but as it is we have started a serious, significant, endless project in our afternoon hours. (4) Let us do what is normal on journeys: those who have set out rather late rely on speed to make up the delay. Let us hurry, and let us tackle a task that is perhaps insuperable, certainly great, without using old age as an excuse. My mind grows in stature whenever it sees the size of the undertaking, and it ponders how much of the enterprise, not how much of its own life, still remains.

(5) Some people have worn themselves out writing down the deeds of foreign kings and the sufferings and audacities perpetrated by nations against each other. How much better it is to extinguish one's own evils than to transmit the evils of others to posterity! How

much more important to praise the works of the gods rather than the robberies of Philip or of Alexander, and of others who became famous by destroying nations and were no lesser disasters to mortals than a flood that has swept over all the plains, or a conflagration in which a large proportion of living things has gone up in flames! (6) They write of how Hannibal overcame the Alps; how he unexpectedly brought to Italy a war that had gathered strength from the disasters in Spain; how when his power was broken, even after Carthage,[2] he stubbornly wandered from one king to the next, offering them a commander against the Romans, asking for an army; and how as an old man he did not stop looking for war in every nook and cranny: he could manage without a homeland, but not without an enemy!

(7) How much better it is to ask what ought to be done[3] rather than what has been done, and to teach those who have entrusted everything to fortune that she has granted nothing enduring, that all her gifts blow away more rapidly than a breeze! For she cannot keep still, she delights in replacing joy with sorrow, or at least in blending them. So let no one be confident when things go well, or give up when they go badly: events swing back and forth. (8) Why are you rejoicing? You do not know when the sources of your elation will desert you: they will end when it suits them, not you. Why are you downcast? You have hit the bottom, now there is the opportunity to rise up again. (9) Adverse circumstances change for the better, desirable ones for the worse. So one must grasp the vicissitudes not just of private households, which a slight misfortune can overthrow, but of ruling households too. Kingdoms have risen from the lowest levels and towered over their rulers, ancient empires have collapsed at the peak of their prosperity, and it is impossible to count how many empires have been destroyed by others. At this very moment god is building up some, overthrowing others, and not putting them down gently but hurling them from their pinnacle so that nothing will be left. (10) We believe such things are great because we are small: many things derive their greatness not from their intrinsic nature but from our lowly status.

What is most important in human life? Not filling the seas with fleets, nor setting up standards on the shore of the Red Sea, nor, when the earth runs out of sources of harm, wandering the ocean

to seek the unknown; rather it is seeing everything with one's mind, and conquering one's faults, which is the greatest victory possible. There are countless people who have been in control of nations and cities, very few who have been in control of themselves. (11) What is most important? Raising your mind above the threats and promises of fortune, thinking that nothing is worth hoping for. For what have you to desire? Whenever you sink back from engagement with the divine to the human level, your sight will go dim, just like the eyes of those who return from bright sunlight to dense shadow. (12) What is most important? Being able to endure adversity with a glad mind, to experience whatever happens as though you wanted it to happen to you. For you ought to have wanted it to, if you had known that everything happens according to god's decree. Crying, complaining, and moaning are rebellion. (13) What is most important? A mind that is brave and defiant in the face of calamity, not just opposed but hostile to luxury, neither courting nor fleeing danger; one that knows not to wait for fortune but to create it, to go to face both forms[4] unafraid and undismayed, unshaken either by the turmoil of the one or the glitter of the other. (14) What is most important? Refusing to let bad intentions enter your mind; raising pure hands to heaven; not seeking any good thing if someone else must give it or must lose it so that it may pass to you; wishing for a sound mind (something that can be wished for without competition); regarding the other things rated highly by mortals, even if some chance brings them into your home, as likely to exit by the door they entered. (15) What is most important? Raising your spirits high above chance events; remembering your human status, so that if you are fortunate, you know that will not last long, and if you are unfortunate, you know you are not so if you do not think so. (16) What is most important? Having your soul on your lips.[5] This makes you free not according to the law of the Quirites, but according to the law of nature.[6] A free person is one who escapes enslavement to himself, which is constant, unavoidable, oppressing by day and by night equally, without break, without respite.[7] (17) Enslavement to oneself is the most severe enslavement, but it is easy to shake it off if you stop expecting a lot from yourself, if you stop making money for yourself, if you set before your eyes both your nature and your age, even if it is very young, and say to yourself, "Why am I going crazy? Why am I panting? Why am I

sweating? Why am I working the land, or the forum?[8] I don't need much, and not for long."

(18) For these reasons[9] it will be useful for us to investigate nature: first, we shall leave behind what is sordid; next, we shall keep our mind, which needs to be elevated and great, separated from the body; next, when our critical faculty has been exercised on hidden matters, it will be no worse at dealing with visible ones. And nothing is more visible than these remedies which are learned in order to counter our wickedness and madness, things we condemn but do not forsake.

(1.1) So let us inquire about terrestrial waters,[10] and let us investigate how they occur—whether, as Ovid says, "There was a spring free from mud, silvery, with bright waves,"[11] or, as Virgil says,

> from where through nine mouths, with a huge roar coming
> from the mountain,
> the sea bursts forth, and covers the fields with the sounding
> waves,[12]

or, as I find in your poetry, my dearest Lucilius,[13] "The Elean river leaps out from Sicilian springs,"[14] or some <other> cause supplies the water—how so many huge rivers flow day and night, why some swell with winter waters, others rise when the other rivers are subsiding. (2) For the present we shall separate the Nile from the crowd, since it has its own unique character, and we shall assign a special date to it.[15] Now let us look at ordinary waters, cold as well as hot (in their case we shall need to inquire whether they are created hot or become so). We shall also discuss others distinguished either by flavor or by some useful property: for some benefit the eyes, some the muscles, some cure chronic ailments where the doctors have given up hope, some heal ulcers, some, when taken as a drink, give relief internally and alleviate complaints of the lungs or internal organs, some staunch bleeding.

(2.1) The tastes of individual waters are as varied as their uses. Some are sweet, others are pungent to various degrees: for there are salt and bitter ones, or medicinal ones, some of which we describe as flavored with sulphur, iron, or alum. The taste indicates the effect. (2) There are many other distinctions, first of touch (there are cold and hot), then of weight (there are light and heavy), then of color (there are pure, muddy, blue, bright), then of healthiness (there are

beneficial ones and deadly ones). There are waters that become solidified into stone, some thin, some dense. Some provide nourishment, some pass through without any benefit to the drinker, some when drunk promote fertility.

(3) <All waters are either stationary or moving; either they are collected or they have various veins.>[16] The lie of the land determines that water either stands still or flows: on a slope it flows; on level or low-lying land it is retained and forms pools. Sometimes it is pushed uphill by breath:[17] but then it is being forced, not flowing. It is collected from rainfall; from its own spring it emerges naturally. But there is nothing to prevent water from both being collected and emerging naturally in the same spot, as we see in the Fucine lake: the surrounding mountains channel into it any rain water that pours down, but there are large, hidden veins in the lake itself. So even after the winter torrents have flowed down, it preserves its appearance.

(4) So first let us investigate how the earth has the resources to maintain the flow of the rivers, and where all that water comes from. We are surprised that the seas do not register the arrival of water from the rivers: we should be equally surprised that the earth does not register the loss as they flow away. What is it that either has filled the earth up so that it can provide all this from some hidden reservoir, or else continuously replenishes it? Whatever explanation we give for rivers will also apply to streams and springs.

(5) Some people think that the earth immediately receives back all the water it has discharged; so the seas do not get bigger because they do not absorb what has flowed into them, but at once give it back. The water passes below the earth in hidden channels, and what arrived openly returns secretly. The sea is filtered along its course, because it is pounded as it goes through the numerous twists and turns within the earth, and loses its bitterness and disagreeableness; thanks to all the variety of soils, it sheds its flavor and turns into pure water.

(6.1) Some people think that the earth discharges again everything that it receives from rainfall, and they offer this argument: that there are very few rivers in those regions where rainfall is rare. (2) They say that the deserts of Ethiopia are dry and that few springs are found in the interior of Africa because the climate is boiling hot and virtually always like summer. So the sands lie barren, without

trees, without cultivation, since they are moistened by only infrequent rain, which they at once swallow up. On the other hand, it is well known that Germany, Gaul, and, where it borders on them, Italy, are awash with streams and awash with rivers because they have a damp climate, and not even the summer is free from rain.

(7.1) You see that many objections can be brought against this view. First, I, who am devoted to digging my vineyards, assure you that no rainfall is heavy enough to wet the soil to a depth of more than ten feet. All the moisture is absorbed in the outer crust, and does not descend lower down. (2) So how can rain support powerful rivers, when it moistens only the surface of the earth? "But most of the rain is carried off in river channels to the sea. The earth absorbs only a little, and does not retain even that: for either it is dry and soaks up whatever pours down onto it, or it has had its fill, and repels anything that falls surplus to its desires. Therefore rivers are not swollen by the first rainfalls, because the thirsty earth sucks them all into itself." (3) But just think of how some rivers burst out from rocks and mountains. What will rain contribute to them, since it runs down over bare crags and has no soil to soak into? Add that in the driest locations wells are sunk to a depth of two or three hundred feet or more, and discover rich veins of water at a depth to which rainwater does not penetrate; you will realize that down there it is not celestial water, nor collected water, but so-called living water. (4) This view is refuted by the following argument too: some springs well up on the very highest summits of mountains. It is clear that they are driven upward, or are created there, since all rainwater runs downward.

(8) Some people think that, just as on the outer surface of the earth there are huge marshes and great, navigable lakes, and just as seas stretch out across huge areas and flow into fjords, so the interior of the earth abounds in fresh water, which forms lakes just as broad as the ocean and its gulfs in our world, or rather all the broader, because deep down the earth spreads out further. So those rivers are discharged from that deep-seated supply. Why are you surprised that the earth does not register their removal, since the seas do not register their arrival?

(9.1) Some people support the following explanation: they say the earth has hollow cavities inside itself, and a lot of breath, which, being buried in deep darkness, is inevitably cold. Being sluggish

and immobile, once it is unable to sustain itself, it turns to water. (2) Just as above us transformation of the atmosphere produces rain, so beneath the earth it produces a river or a stream. Above us it cannot remain sluggish and oppressive for long (for sometimes it is rarefied by the sun, sometimes it is expanded by winds, and so there are long intervals between rain showers); but below the earth whatever converts it to water is always the same—endless darkness, everlasting cold, inert denseness; so it will constantly be generating springs or rivers. (3) We believe that earth is subject to change; and any exhalations it gives off, since they are not dispersed in the open air, at once grow dense and turn into liquid. Here you have the first explanation of how water is produced under the earth.

(10.1) You can add that everything is produced from everything—air from water, water from air, fire from air, air from fire.[18] So why should water not be produced from earth as well? If it can change into other things, it can change into water too, or rather, especially into water. For both things are related, both are heavy, both are dense, both are driven to one of the extremities of the world.[19] Earth is produced from water: why shouldn't water be produced from earth? (2) "But rivers are big." When you see their size, look also at the size of what they come from. Since they flow steadily, and some rush along rapidly, you are surprised that renewed supplies of water are constantly available to them. You might as well be surprised that, when winds move the entire atmosphere, breath is not exhausted but flows constantly day and night, and that it does not move in a fixed channel, as rivers do, but travels on a broad front across a huge expanse of the sky! You might as well be surprised that there is any wave left to follow behind all those that have already broken! (3) Nothing is exhausted if it returns to itself. There are reciprocal exchanges between all the elements: whatever one loses turns into another, and nature weighs its parts as if they were placed on a pair of scales, to make sure that the world does not become unbalanced because the equality of its components is disturbed. (4) Everything is in everything. Not only does air turn into fire, but it is never without fire: take away its heat and it will grow stiff, stand still, become hard. Air turns to moisture, but nevertheless it is not without moisture. Earth produces both air and water, but it is never without water any more than it is without air. So the mutual transformations are easier

because the things they are due to change into are already mixed in with them. (5) Thus the earth contains moisture, and it forces it out. It contains air, which the darkness of the subterranean cold condenses, so as to produce moisture. The earth can itself change into moisture too, and it exploits its own nature.

(11.1) "But tell me," someone says, "If the causes of the appearance of rivers and springs are everlasting, why do they sometimes dry up and sometimes emerge in places where they did not exist previously?" Often the channels are disturbed by an earthquake, and subsidence severs the water's route; the blocked water seeks new exits and attacks at some point, or is diverted from one place to another by the upheaval in the earth itself. (2) In our experience it commonly happens that rivers whose channels are blocked at first flow backward, then, since they have lost their way, they make another. Theophrastus[20] says that this happened on mount Corycus, on which new springs emerged after an earthquake. (3) He thinks that other causes too can come into play and either elicit water or deflect and divert it from its course. Once mount Haemus was short of water, but when a tribe of Gauls that was blockaded by Cassander took to the mountain and chopped down the forests,[21] an enormous supply of water appeared; obviously the woods were drawing on this for their nourishment, and when they were felled, the liquid was no longer used up on the trees and flowed above ground. (4) Theophrastus says that the same also happened near Magnesia. But, with all due respect to him, this is not plausible, because generally the places with most shade have the most water, and that would not be the case if trees dried up the water supply. They get their nourishment from near the surface, but rivers flow from deep within and are generated beyond the depth to which roots can extend. Then trees that have been cut down need more moisture: for they soak up enough not just to stay alive, but to grow.

(5) He also says that near Arcadia, which was a city on the island of Crete, springs and streams stopped flowing because the land was no longer cultivated after the city was destroyed; but when it got its farmers back, it got its waters back too. He suggests that the reason for the drought was that the earth solidified and hardened, and, left undisturbed, it could not let the rainwater penetrate. But in that case why do we see many springs in completely deserted places? (6) And

we can find more places that began to be cultivated because of their water than places that began to have water because they were being cultivated. It is not rainwater that causes enormous rivers that can accommodate large boats immediately below their source: you can infer this from the fact that throughout winter and summer the flow from the source remains constant. Rain can produce a torrent, but not a river that flows between its banks with a steady current; rain does not produce it, but speeds it up.

(12.1) Let us look at this again a bit more deeply, if you agree, and then you will know that you have no further questions to ask, since you have arrived at the true origin of rivers. Without doubt a perpetual supply and flow of water produces a river. So you ask me how water is produced? I shall ask in turn how air or earth is produced. (2) But if there are four elements in nature, you cannot ask where water comes from: for it is one-quarter of nature. So why are you surprised that such a large portion of nature can constantly pour something out from itself? (3) Just as air, which is also a quarter of the world, makes winds and breezes move, so water makes streams and rivers move. If wind is flowing air, a river is flowing water too. I have granted water more than enough power when I have said, "It is an element"; you realize that what proceeds from it cannot peter out. **(13.1)** I shall add, as Thales says,[22] that "it is the most powerful element." He thinks that it was the first element, and everything arose from it. We too hold the same opinion, or something close to it: for we say that it is fire that seizes control of the world and turns everything into itself;[23] then it becomes faint and weak and dies down, and when the fire is extinguished, nothing else is left in nature except moisture. The hope of a future world lies hidden in it. (2) So fire is the end of the world, and moisture is its starting-point. Are you surprised that rivers can constantly emerge from the substance that stood in for everything and from which everything comes? As things separated out it was reduced to a quarter share, in a location where it could provide sufficient material to produce rivers, streams, and springs.

(14.1) The following theory of Thales'[24] is silly. He says that the earth is supported by water and floats like a ship, and it is being tossed by the waves, thanks to its mobility, when it is said to be quaking: "So it is not surprising if it overflows with moisture that can pour

out rivers, since it is all floating on moisture." (2) Boo this old, naive theory off the stage: <***> and you have no reason to think that water enters the earth through cracks and forms bilge-water.[25]

The Egyptians posited four elements, from each of which a pair is formed: they think that air is male when it is wind, female when it is misty and still; they call the sea "virile water," and all other water "womanly"; they call fire "masculine" when it burns with a flame, and "female" when it shines, harmless to the touch; stronger earth, such as rocks and crags, they call "male," and they give the name "female" to workable, cultivated soil. (3) The sea is all one, established as such from the beginning, of course; it has its own veins from which it is renewed and forms tides. Just like the sea, so this gentler water has vast, hidden reserves, which no river's current will exhaust. The scale of its resources is hidden, but enough is emitted to allow a constant flow.

(15.1) There are some points here that we can vote for, but I would add this to the motion:[26] I think that the earth is controlled by nature, and on the model of our own bodies, in which there are both veins and arteries; the former are receptacles for blood, the latter for breath. In the earth too there are some passages through which water runs, others through which breath does; and nature has created such a resemblance to the human body that our ancestors too spoke of "veins" of water. (2) Now, in us there is not just blood but many kinds of fluid, some essential, some corrupted and rather too thick; in the head there is the brain, mucus, saliva, and tears; in the bones, marrow and something added to the joints as a lubricant so that they can bend more readily. In just the same way in the earth as well there are several kinds of fluid: (3) some that harden when fully developed (from them comes the entire harvest of metals—from which greed seeks out gold and silver—and substances that turn from liquid to stone),[27] and some that are formed from the decay of earth and moisture (such as bitumen and other things of that sort). This is the explanation for the kinds of water that come into being according to the law and will of nature.

(4) But, as in our bodies, so in the earth liquids often go bad: either a blow, or some upheaval, or the old age of the location, or cold, or heat corrupts their nature; a festering process forms a liquid, which may be either long-lasting or short-lived. (5) Now, in our

bodies, when a vein has been severed, the blood runs until it has all flowed out, or until the cut in the vein <has healed> and the bleeding has subsided and been staunched, or some other factor has checked the flow of the blood; and in just the same way in the earth, when veins are unsealed and opened, a stream or river runs out. (6) The size of the vein that is opened makes a difference: sometimes it gives out when the water is exhausted; sometimes it is blocked by some obstacle; sometimes it heals over with a scar, as it were, and seals off the path it had opened up; sometimes the earth, which we have said is subject to change,[28] loses its ability to convert its nourishment into moisture. (7) But on occasion what is exhausted can be renewed: sometimes it recovers its own strength; sometimes strength is transferred from elsewhere. For empty things placed next to full ones often divert moisture to themselves; often earth, if it putrefies easily, is itself dissolved and liquefied. The same occurs below the earth as in the clouds, that <the air> is condensed, and, when too heavy to remain in its natural state, it produces moisture; often a thin, dispersed liquid collects like dew, and trickles from many directions into one place (water-diviners call it sweat, because drops are either extruded by the pressure in the region or are extracted by heat). (8) This feeble trickle is scarcely sufficient for a spring. But from large caverns and large reservoirs there emerge rivers, sometimes issuing gently, if the water just flows downhill under its own weight, sometimes violently and noisily, if breath is mixed in with it and forces it out.

(16.1) "But why are some springs full for six hours and dry for six?" It is unnecessary to name individual rivers that are wide in certain months and narrow in certain others, and to look for an opportunity to tell tall stories, seeing that I can give the same explanation for them all. (2) Just as quartan fever turns up on the hour,[29] just as gout keeps to time, just as menstruation sticks to a set day if nothing intervenes, just as childbirth is ready to happen in the right month, in just the same way waters have intervals at which they withdraw and return. Some intervals are shorter, and therefore striking; others are longer but no less fixed. (3) Is it surprising when you see the chain of events and nature advancing as preordained? Winter never goes astray; summer heats up at the right time; the change to autumn and spring occurs at the usual point; solstices and equinoxes alike recur on the right day.

(4) Beneath the earth too there are laws of nature that are less well known to us, but no less fixed. Believe that whatever you see above happens below. There are vast caves there too, there are huge depressions and empty spaces with mountains towering above on every side, there are sheer, bottomless holes that have often swallowed cities that subsided into them and have buried enormous ruins in the depths (5)—these are filled with breath, for there is no vacuum anywhere—<there are> also pools oppressed by darkness and broad lakes. Living creatures live in them too, but they are sluggish and imperfectly formed, since they are generated in air that is dark and dense, and water that is stagnant; they are mostly blind, like moles and underground mice, which have no vision because it is redundant. That is why, as Theophrastus declares,[30] fish are dug out of the ground in some places.

(17.1) At this point you can think of many witty things to say, as with some tall story: "To think of someone going fishing not with nets or hooks but with a pick-axe! I'm waiting for someone to go hunting in the sea!" But why should fish not cross over to the land, if we have crossed the seas and found new homes? (2) Are you surprised by this? How much more incredible are the achievements of luxury! How often it either fakes or surpasses nature! Fish swim on a couch, and one is caught beneath the table to be transferred onto the table immediately. A mullet does not seem fresh enough unless it has died in the guest's hand. They are put in glass bowls and brought in, and as they die people watch their color; death causes many alterations to it, as their breathing struggles. They kill other fish in the fish sauce, and marinate them while still alive. (3) Where does that leave people who think it just a tall story that a fish can live under the earth and be dug up instead of caught? How incredible it would seem to them if they heard of a fish swimming in fish sauce, and being killed not *for* dinner but *at* dinner, after it had been treated like a pet for ages and had fed the eyes before it fed the gullet!

(18.1) Allow me to put our inquiry to one side for a short while and castigate luxury. "There is nothing," you say, "more beautiful than that dying mullet. As the act of struggling weakens its breathing, first it is suffused with redness, then with pallor; its scales keep changing hue, and its color shifts through shades poised uncertainly between life and death. Luxury has long been lethargic, idle, and negligent,

and has only just woken up, has only just realized that it was being cheated and defrauded of something so fine. Up till now only fishermen enjoyed such a beautiful sight. (2) Why bring me a cooked fish? Why a dead one? Let it breathe its last on the serving dish." We used to be surprised that they were so fussy that they would not touch a fish unless it had been caught the same day, and, as they say, it really tasted of the sea. So it was brought at a run, so the road was cleared for couriers who raced along panting and shouting. (3) How their self-indulgence has progressed! Now they regard a dead fish as rotten. "It was caught today." "I can't trust you on this important matter. I've got to see for myself. Bring it here, let it expire in front of me." The stomachs of the gourmets have become so fastidious that they cannot sample anything they have not seen swimming and twitching at the dinner-party itself. How the resourcefulness of deadly luxury has increased! Madness that despises the familiar devises each day something so much more subtle and more elegant! (4) We used to hear people say, "Nothing is better than a rock mullet," but now we hear, "Nothing is more beautiful than a dying mullet. Let me hold the glass vessel for it to leap and quiver in." After they have sung its praises for ages, it is removed from that transparent aquarium. (5) Then each person, according to his expertise, points and says, "See how that red color has flared up, more vivid than any red pigment! See those veins running along its sides! Look, you'd think its stomach was full of blood! Look, brilliant white coloring, and blue, has appeared below its forehead! Now it is stretching out and going pale and turning to a single color." (6) None of these people sits by a dying friend, none can endure seeing the death of his own father, though he has prayed for it.[31] Hardly any of them follows a family funeral procession to the pyre! The final hour of a brother or neighbor is deserted, but people race to the death of a mullet: "For nothing is more beautiful than that!" (7) I cannot stop myself from using words recklessly from time to time and crossing the boundary of propriety: in an eating-place they are not content with teeth, and stomach, and mouth; they are gluttons with their eyes as well.

(19.1) But, to return to my subject, listen to evidence that there are large quantities of water hidden below the earth, and that they produce fish whose inactivity makes them repulsive. If this water ever emerges, it brings with it a great mass of living creatures, ghastly

to look at and disgusting and harmful to taste. (2) Certainly when such water sprang up in Caria near the city of Idymus, the new river exposed fish to a sky they had never known till that day, and everyone who ate them died. This is not surprising, for their bodies were plump and bloated, as a result of long indolence; they had had no exercise, and had been fattened by the darkness and deprived of light, on which sound health depends. (3) An indication that fish can live at that depth below the earth may come from the fact that eels are generated in concealed locations. They too are an indigestible food because of their idleness, especially if they are completely hidden by deep mud.

(4) So the earth contains not just veins of water which can be channeled together to produce streams, but also rivers of vast size, some of which flow out of sight all the time; <others flow in the open for a while> until they are swallowed up by some hollow in the earth; others emerge beneath some lake. For who does not know that there are some pools that are bottomless? Why is this relevant? To make it clear that this water provides everlasting material for great rivers. Its bottom cannot be reached, as the sources of rivers can.[32]

(20.1) "But why does water have different tastes?" From four causes: first, from the soil it passes through; second, also from the soil, if it is transformed into water; third, from breath that is reconfigured as water; fourth, from the taint that water often suffers when damaged and corrupted. (2) These causes give water different flavors, give it medicinal power, give it unwholesome breath and a harmful smell, give it lightness and heaviness, and give it an excess of either heat or cold. It is important if the water passes through places full of sulphur or potash or bitumen, for one risks one's life drinking water corrupted in that way. (3) Hence what Ovid writes about:

> The Cicones have a river which when drunk turns the vital
> organs to stone, which covers what it touches in marble;[33]

it is medicinal, and contains a slimy substance that has the property of sticking to bodies and hardening them. Just as pozzolana,[34] if it comes into contact with water, turns to stone, so, conversely, this water, if it touches a solid, adheres and sticks to it. (4) That is how things thrown into Lake *** have turned to stone when they are later pulled out.[35] This happens in certain places in Italy: if you submerge

a stick or a blade of grass or foliage, you pull out a stone a few days later. For the slime envelops the object and gradually forms a coating on it. You will find this less surprising if you observe that the water at Albulae, and sulphurous water generally, hardens on its channels and pipes.

(5) One of these causes applies to those lakes "which, if anyone swallows them," as the same poet says, "he either goes mad or falls into an amazingly heavy slumber."[36] They have an effect similar to neat wine, but stronger: for just as drunkenness, until it is dried out, is a kind of madness, or else falls into an exceedingly heavy sleep, so the sulphurous power of this water, containing a strong poison derived from the harmful air, either drives the mind mad or overpowers it with slumber. (6) This is the harmful effect of

> the river of the Lynceii;
> if anyone gulps it down his unrestrained throat,
> he staggers around just as if he had drunk neat wine.[37]

(21.1) People who have looked down into certain caves die. The poison is so swift-acting that it strikes down birds as they fly past. Such is the air, such is the region from which the deathly water seeps. If the infection in the air and the region is less severe, the harm done is more moderate too, and it merely affects the muscles, which are paralyzed as if by drunkenness. (2) I am not surprised that the region and the air infect the water and make it resemble the places through which and from which it comes. The flavor of the fodder appears in milk, and the character of the wine is found in vinegar; there is nothing that does not show traces of the thing from which it has originated.

(22) There is another kind of water that we believe began with the world: if it is eternal, this water has always existed too, or if it has some starting point, this water too was organized along with everything else. What is this water, you ask? The ocean and the seas that branch off it and flow into the land. Some people also think that the rivers whose nature is inexplicable originated along with the world itself, for instance the Danube and the Nile, enormous rivers, too remarkable to allow us to say that they have the same origin as the rest. **(23)** So waters can be classified as follows, it would appear: some <came into being along with the world, some> after it; of the

latter, <some are terrestrial, some> are celestial, emitted by the clouds; of the terrestrial ones, some, so to speak, float on top, for they creep over the earth's surface; others are hidden, and I have given an account of them.

(24.1) Why are some waters hot—some actually so boiling hot that they cannot be used unless they have either cooled off in the open or have been made lukewarm by the addition of cold water? Several explanations are given. Empedocles thinks that the water is heated by the fires that the earth conceals underground in many locations,[38] if they are underneath the soil through which the water passes. (2) We are used to constructing water-heaters, and boilers, and various devices in which we arrange pipes of thin copper that spiral round and slope gently down, so that the water repeatedly circles round the same fire, and flows a sufficient distance for it to absorb the heat. So the water enters cold and flows out hot. (3) Empedocles thinks that the same happens beneath the earth. He is not mistaken—believe the people of Baiae, whose baths are heated without fire. Boiling hot breath is channeled into them from a hot location; flowing through pipes, it heats the walls and the pools in the baths in exactly the same way as under-floor fire. All the cold water becomes hot as it passes, and it does not absorb any flavor from the furnace-room, because it is enclosed as it flows past. (4) Some people think that as water passes through places full of sulphur or potash it gains heat thanks to the material through which it is flowing. They appeal to the evidence of the smell and taste; for the water reproduces the characteristics of the substance that has heated it. To save yourself from being surprised that this happens, pour water over quicklime, and it will boil.

(25.1) Some waters are deadly, but have no distinctive smell or taste. Near Nonacris in Arcadia the Styx, as it is called by the local population, deceives visitors, because neither appearance nor smell make it suspect, rather like the poisons of the great experts, which can only be detected upon death. This water I was just talking about causes harm extremely swiftly, and there is no opportunity to take an antidote, because as soon as it is drunk it hardens; like gypsum it solidifies under water, and it makes the vital organs seize up. (2) There is equally harmful water in Thessaly near Tempe; both wild and farm animals avoid it. It penetrates iron and bronze, so great is

its ability to corrode even hard objects. It does not support any trees either, and it kills plants.

(3) Some rivers have remarkable powers. For there are some that when drunk dye flocks of sheep, and within a certain time sheep that were black have white wool, and those that arrived white go away black. In Boeotia two rivers have this effect, one of which is called Melas from its effect.[39] They each flow out of the same lake, to produce different results. (4) In Macedonia too, according to Theophrastus,[40] people who want to make their sheep white bring them <to the Haliacmon>;[41] when they have drunk from it for a while, they change color just as if they had been dyed. But if they need dark wool, a free dyer is to hand: they drive the same flock to the Peneus. I have good authorities for there being in Galatia a river that has the same effect on all animals, and one in Cappadocia that when drunk changes the color of horses, though of no other animal, and produces white markings on their skin.

(5) It is well-known that there are some lakes that buoy up non-swimmers. In Sicily there used to be, and in Syria there still is a pool on which bricks float, and things thrown in cannot sink, even if they are heavy. The reason for this is obvious. Weigh anything you like, and put water on the other side of the scales, making sure you have the same volume of each. If the water is heavier, it will support the object that is lighter than itself, and the lighter it is, the more it will stand out above the water; [heavier things will sink;][42] but if the weights of the water and of the other thing you are weighing it against are equal, it will neither go to the bottom nor stand out, but will be level with the water and will float, but almost submerged and not protruding at any point. (6) That is why some pieces of timber are carried almost entirely above the water, some are half submerged, some sink till they are level with the water. For when the weight of each is equal, neither thing gives in to the other; heavier things sink, lighter things are supported. However, heavy and light depend not on our assessment but on comparison with the thing that is to buoy them up. (7) So when water is heavier than the body of a man or of a rock, it does not allow what does not overcome it to sink. That is how it happens that in some pools not even stones go to the bottom. I am talking about solid, hard ones, for many stones are pumice-

like and light. In Lydia there are islands formed from them that float; Theophrastus is the authority for this.[43] (8) I myself have seen a floating island at Cutiliae; another floats on lake Vadimon (that is a lake in the territory of Statonia). The island at Cutiliae has trees and supports plants too, but it is carried by the water and is driven to and fro not just by a wind but by a breeze; it never stays put in one place for a day and a night, so easily is it moved by a gentle gust. (9) There is a twofold explanation for this: the weight of the water that is medicinal and therefore heavy; and the material of the island itself, which is capable of floating and does not have a solid body, even though it supports trees. Perhaps the dense liquid has assembled and bound together light tree-trunks and leafy branches that were scattered across the lake. (10) So even if there are rocks in the island, you will find they are eroded and porous, of the type produced by a hardened liquid, especially around <the mouths> of medicinal springs and streams where the impurities in the water have coalesced, and the foam is solidified. Anything formed from something insubstantial and loose-textured is necessarily light.

(11) Some things cannot be explained: why the water of the Nile makes women more fertile, so much so that it has loosened the organs of some women, allowing conception, after they had been closed by a long period of infertility; and why some waters in Lycia protect women's pregnancies and are often sought out by those whose wombs are not very retentive. As far as I am concerned, I treat these as ill-founded rumors. It is believed that some waters cause eczema to appear on the body, some cause psoriasis and ugly white blotching, whether through external contact or when drunk. They say that this defect is found in water collected from dew. (12) Who could fail to suppose that the waters that form rock-crystal are very dense?[44] But the opposite is true: it involves very light waters, which cold can freeze very easily precisely because of their lightness. The origin of this kind of stone is obvious to the Greeks from their word for it, for they give the name "crystallus" both to this transparent stone and to the ice from which the stone is believed to come. For celestial water contains very little earth, and, when it has gone solid, it is made more and more dense by persistent, long-lasting cold. Eventually all the air is excluded, the water becomes highly compressed, and what had been liquid is turned into stone.

(26.1) Some rivers rise in summer, like the Nile, which will be dealt with later.[45] Theophrastus is the authority for saying that in the Black Sea too some rivers rise in the summertime.[46] People think there are four explanations. Either it is because at that time earth can most readily be changed into liquid; or because there is heavier rain in some remote region, and the rainwater passes through hidden tunnels and wells up imperceptibly from below. Third, if the river mouth is lashed by constant winds, and the river is driven back by the waves and comes to a halt, it appears to rise because it is not flowing out. The fourth explanation involves the heavenly bodies: for in certain months they are more oppressive and drain moisture from the rivers; when they have moved further away, they consume and draw up less;[47] thus what used to contribute to expenditure contributes to growth.

(3) Some rivers visibly descend into a cave and thus disappear from sight. Some are gradually absorbed, disappear, and then after an interval they return and recover their name and their course. The explanation is clear: there is empty space beneath the earth, and all liquid naturally descends to a lower point and to an empty space. So rivers are welcomed there and follow a hidden course; but as soon as some solid barrier is encountered, they break through at a point where there is less resistance to their escape and resume their original course.

> (4) Thus, after the Lycus has been swallowed by a chasm in the earth,
> it emerges far from here and is reborn from another mouth.
> Thus the great Erasinus is at one point imbibed, at another,
> after flowing with silent eddies, it is restored among the Argive waves.[48]

In the east too the Tigris does the same: it is swallowed up, is missed for a long time, and eventually emerges in a far-distant place, but there is no doubt it is the same river.

(5) Some springs eject impurities at regular intervals, as the Arethusa in Sicily does every fourth summer, during the Olympics. This gives rise to the view that the Alpheus travels all that way from Achaea, flowing under the sea, and only emerges on the shore at Syracuse; and so on the days when the Olympics are taking place,

dung from the sacrificial victims is thrown into the flowing river and surfaces there. (6) This seemed credible to you, as <I said> at the start,[49] my dearest Lucilius, and to Virgil, who addresses Arethusa:

> So, when you flow beneath the Sicilian waves,
> may bitter Doris not mix her waves with yours.[50]

In the Rhodian Chersonese there is a spring that after a long period of time becomes muddy and disgorges the offending material from deep within, until it is freed and purified. (7) In some places there are springs that expel not just mud, but also leaves, bits of pottery, and rotting sediment. The sea does this everywhere, for its nature is to drive all filth and sewage onto the shores. Some parts of the sea do this at regular intervals; for example, near Messene and Mylae the force of the turbulent sea ejects something resembling dung, and boils and seethes with a disgusting color, giving rise to the myth that the oxen of the Sun are stabled there. (8) But some things are difficult to account for, particularly when the timing of what is under investigation is unresearched or uncertain, which means that the immediate and antecedent cause cannot be established. But this cause is universal: all standing, confined waters naturally purify themselves. For in those that are moving, impurities cannot remain, for the force of the current carries them along and takes them away. Waters that do not dispatch whatever settles in them become unsettled to a greater or lesser degree. The sea hauls corpses and equipment and the other debris of shipwrecks from the depths, and is cleansed not just by storm and wave, but also when it is peaceful and calm.

(27.1) This topic reminds me to inquire how most of the earth is overwhelmed by the waves when the fated day of the flood arrives: is it achieved by the might of the ocean, and does the outer sea come surging up over us? or does constant, unremitting rain and a persistent winter that squeezes out the summer burst the clouds and hurl down huge quantities of water? or does the earth pour out rivers more liberally, and open up new springs? or is there no single explanation for such a catastrophe, but do all the causes conspire: do the rains fall, the rivers rise, and the seas stir from their sea-beds and charge forward, all at once?[51] Does everything attack en masse to destroy the human race? (2) That is right: nothing is difficult for nature, especially when she is hurrying toward her own finale. For the creation

of everything, she uses her powers sparingly and rations herself out in barely perceptible increments; but she arrives at destruction suddenly, at full speed. What a long time it takes for a baby to continue from conception through to birth! How much effort goes into raising the young child! With what careful nourishment the vulnerable body at last reaches maturity! But how effortlessly it is destroyed! Cities take an age to establish, an hour to demolish; ashes are produced in a moment, a forest takes a long time. Everything needs plenty of protection to survive and flourish, but it disintegrates swiftly and suddenly. (3) Any deviation by nature from the present state of affairs is sufficient for the destruction of mortals. So when that inevitable moment arrives, fate sets in motion many causes at once; for such a change cannot occur without the world being shaken.

(4) According to what some people, including Fabianus, think,[52] first of all excessive rains fall: there is no sunshine, the sky is grim with clouds, there is constant mist, and the dampness produces thick gloom, but the winds never dry things out. Then the crops are spoiled, corn-fields, growing without grain, are ruined. When plants sown by hand have rotted, marsh grasses grow in all the fields. (5) Soon stronger plants also suffer damage: roots are loosened, and trees fall down; vines and shrubs of all sorts are not supported by the soil, which is soft and muddy; now, being water<-logged>, it does not even support grass or lush pasture. People are struggling with hunger, and hands reach out for the foods of olden days; the ilex and the oak are shaken,[53] and so is any tree that stood on high ground, firmly held by cracks in the rock. (6) Buildings become unsteady and sodden, foundations subside as the water penetrates down to their base, and all the ground is under water. There are fruitless attempts to shore up unsteady buildings, for all the props are planted in slippery, muddy soil; nothing is firm.

(7) After the storm-clouds attack more and more strongly, and the snows that have piled up over centuries are melted, a torrent, tumbling down from the highest mountains, sweeps away unstable forests and sends dislodged rocks rolling downhill after their cohesion has been weakened. It washes away farmhouses and carries down flocks mingled with their owners. After grabbing smaller buildings and carrying them off as it passes, it eventually detours more violently against larger ones, and sweeps away cities and populations

trapped within their walls, uncertain whether to lament collapse or shipwreck; for the forces of demolition and of drowning arrive at the same instant. The torrent grows as it advances, sweeping up other torrents into itself, and it devastates level ground everywhere. Finally it pours into the seas, laden with the vast wreckage of nations.

(8) Rivers that are huge by nature and swift-flowing even without storms have burst their banks. What do you think becomes of the Rhone, what do you think becomes of the Rhine and Danube? Their current is violent even within their own channels: what happens when they have spilled over and made themselves new banks, and have cut through the soil and abandoned their riverbeds? (9) With what violent momentum they surge onward, when the Rhine, flowing over the plains, has not been weakened even by this expansion, but has propelled its wide-spreading waters as if it were going through a narrow channel; when the Danube is no longer skirting the foot of the mountains or half way up them, but is attacking the ridges themselves, carrying along sodden mountainsides, and shattered cliffs, and promontories that occupy large regions and have separated from the mainland as their foundations were sapped. Then, finding no way out (for it has shut off all the exits itself), it wheels round and sweeps away an enormous stretch of land and cities in a single maelstrom. (10) Meanwhile, the rains persist, the sky becomes more threatening; it continually piles woe on woe. What had once been cloudy weather is night, a night made dreadful and frightening by the sporadic appearance of a terrible light; for lightning-bolts flash frequently, and gales lash the sea, now for the first time swollen by the arrival of the rivers, and too small for itself. Now it pushes the shoreline forward and is not confined within its boundaries. But torrents stop it from expanding and drive the surge back. However, most of them are halted, as it were, by a grudging river-mouth; they flood, and turn the farmlands into a single lake.

(11) Now everything, as far as the eye can see, is covered in water. Every hill is hidden beneath the sea, and everywhere the depth is enormous. Only on the highest mountain ridges are there shallows. People have fled to the tallest peaks with their children and wives, driving their flocks before them. Communication and travel is cut off between these wretched people, for all the lower-lying land is filled with water. (12) The remnants of the human race were clinging to all

the highest points. In their extremity their only source of comfort was that fear had turned to bewilderment. In their dumbstruck state they had no time to be afraid; there was not even any opportunity for grief, since it loses its hold over someone who is too wretched to be aware of suffering. (13) So "the mountains" stick out like islands "and add to the number of the scattered Cyclades,"[54] as that most inventive of poets says, in splendid fashion, just as it suits the grandeur of the subject when he writes, "Everything was sea, and the sea had no shores,"[55] if only he had not reduced the momentum of his inventiveness and subject-matter to childish silliness with "A wolf swims among sheep, and the waves support tawny lions."[56] (14) Frivolity when the earth is swallowed up shows a lack of serious-mindedness. His writing has shown greatness, and he has captured a vision of all the turmoil when he writes,

> The rivers break out and race across the open plains,
> and all at once seize crops and trees, animals and men,
> buildings, and sanctuaries, along with their temples.
> If a house remains standing, yet a bigger wave covers its
> roof-top;
> and towers are about to collapse, overwhelmed, beneath the
> billows.[57]

This is splendid, if he were not concerned with what the sheep and wolves are doing. Is swimming possible in that deluge and that devastation? Has not every beast been drowned by the same force that has swept it away? (15) You have imagined the scene on the scale you needed to when the whole earth was submerged, and the sky itself crashed down to earth. Keep it up: you will know what is appropriate if you reflect that the earth is swimming.

(28.1) Now let us return to our subject. There are some who think that excessive rain can damage the earth but not submerge it. It takes great force to shatter great things: rain will ruin cornfields, hail will dislodge fruit, rivers will be swollen by rain, but they will subside. (2) Some people think that the sea shifts and that they can find the cause of such a catastrophe there; but the damage done by flash floods, or rain, or rivers cannot produce such a huge shipwreck. When that destruction is imminent, when the decision has been taken to renew the human race, I would agree that there are constant downpours,

and the rain shows no let-up; with the north winds and drier breezes held in check, and the south winds <spurred on>, clouds and rivers overflow. But so far all that has been achieved is damage:

> Cornfields are flattened and the farmers lament
> the ruin of their prayers; the long year's fruitless labor is
> wasted.[58]

(3) The earth does not need to be injured, but to be swallowed up. So, after that opening gambit, the seas rise, but higher than usual, pushing their waves beyond the furthest point reached by the most violent storm. Then, as the winds press from behind, the seas propel forward an immense surge that breaks far out of sight of the original shore. When the shoreline has been pushed forward two or three times, and the sea is established on foreign territory, then, as though a barrier has been removed, a tide races forward from the remotest depths of the sea to join battle. (4) For like the air, like the aether,[59] this element has abundant supplies, and those that are unseen are much the more plentiful. They are set in motion by fate, not by the tide (for the tide is a servant of fate), and they make the sea swell up in a huge wave and drive it forward. It rises to an amazing height and towers above the safe refuges of humankind. That is not difficult for water, since it reaches the same height as the land. (5) If the highest points are surveyed, the seas are level with the land. For the earth is level in all directions; its sunken and flat parts are only slightly lower than the elevated ones. It approximates to the curved surface of a sphere. The seas also form part of this, and they combine to create the regular shape of the one globe. But just as someone looking at a plain is deceived by the gentle slope, so we do not recognize the curvature of the sea, and everything that is visible seems to be flat. But the sea is at the same height as the land, and so it does not take a vast amount to raise its level so that it overflows: a slight increase is enough for it to cover something that is level with it; and it does not flow from the shore, where it is lower, but from mid-ocean, where that bulge is.

(6) So just as, when the moon and sun are in conjunction, the equinoctial tide rises higher than all others, so this tide which is unleashed to occupy the land is more violent than the normal highest tides, brings more water with it, and it does not recede until it has

risen above the summits of the mountains it is going to inundate. In some places tides come a hundred miles inland without causing damage, and they maintain the natural order, for they rise to the appropriate level and then recede. (7) But on that occasion the tide is not bound by laws, and its advance is unlimited. "How?" you ask. In the same way as the conflagration will occur.[60] Both events occur when god has decided to inaugurate a better world and to end the old. Water and fire lord it over terrestrial things; they bring about creation, they bring about destruction. So whenever the world has decided on revolution, the sea is sent crashing down over us, just as heat and fire are when another form of extinction is approved.

(29.1) Some people think that the earth is shaken too, and, as the ground splits apart, it exposes new sources of rivers, which gush out more plentifully since they come from full reservoirs.

Berosos, who translated Belus,[61] says that the movement of the stars is the cause of all this. He is so confident in his assertion that he gives a date for both the conflagration and the flood. He maintains that the earth will burn whenever all the stars that now have different courses[62] converge in Cancer and are positioned beneath the same point, so that a vertical line can pass through all their spheres; a flood will occur when the same group of stars converges in Capricorn. The summer solstice occurs in the former constellation, the winter solstice in the latter; these are very powerful zodiac signs, since they are the most important turning points in the annual cycle.

(2) I would accept these causes too (for such a great catastrophe does not have a single origin), and the cause that our people[63] assign to the conflagration should apply here too, I think: whether the world is an animal, or a body, such as trees and plants, governed by nature, from its beginning to its end all that it must do, all that it must undergo, is contained within it. (3) The entire rationality of a future human being is incorporated within its seed, and, while still unborn, the baby contains the law governing the beard and grey hair (for the features of the entire body and of its subsequent growth are there, in miniature, and invisible); and in just the same way the origin of the world encapsulated not just the sun, and the moon, and the motions of the heavenly bodies, and the birth of animals, but equally the forces that would transform the earth. These include the flood, which occurs, just like winter or summer, according to the laws of

the world. (4) So it will not be produced by rain, but by rain as well; not by an invasion of the sea, but by an invasion of the sea as well; not by an earthquake, but by an earthquake as well; not by shaking <the world, but by shaking the world as well>. Everything will assist nature so that nature's decrees may be implemented. But the earth itself will supply the chief cause of its own inundation, for we have said that it can change and dissolve into liquid.[64]

(5) So whenever the end of human history arrives, when the earth's parts have to perish and all be utterly destroyed, in order that primitive, innocent people may be created afresh and no teacher of worse behavior may survive, then more liquid will be produced than there has ever been before. For at present the elements are weighed out as required. One of them needs to be increased so that an imbalance may upset the current equilibrium. Water will be increased: for now there is enough to encircle the land, not to cover it; whatever you add to it must overflow into alien territory. (6) So consider whether earth does not also need to be diminished, so that the weaker may succumb to the stronger. So it will begin to decay, then to decompose and turn to liquid, and to dissolve into a steady stream of putrefaction. Then rivers will spring up beneath mountains and make them crumble under the onslaught. (7) Then fields that are affected will become sodden; all the ground will exude water; the mountaintops will bubble over. Just as healthy parts become diseased, and an ulcer spreads to adjacent areas, so the regions closest to land that is already awash will themselves dissolve and form a trickle, then a fast current; then, as rocks gape apart all over the place, they will rush through the channels and join up all the seas. The Adriatic will be no more, nor the straits of the Sicilian sea, nor Charybdis, nor Scylla.[65] The new sea will overwhelm all those myths, and the ocean that now encircles the land, assigned to its outer edges, will reach the center. (8) What happens next? Winter will cling on to the months that do not belong to it, summer will be kept out, and all the heavenly bodies that dry up the earth will fade away, with their heat suppressed. So many famous names will disappear, the Caspian and Red seas, the Ambracian and Cretan gulfs, the Propontis and the Black Sea, when that deluge spreads a single sea over everything. All distinctions will disappear; everything that has its own place assigned by nature will be mixed together. No one will be protected by city walls or by tow-

ers. Temples will be no use to worshippers, nor the highest points of cities, for the waves will overtake them as they flee and pull them down even from the citadels. (9) Waters will converge from the west and from the east. A single day will bury the human race. All that fortune's indulgence has fostered for so long, all it has elevated above the rest, the noble and the honored alike, and the kingdoms of great nations, all will be sent to the bottom.

(30.1) Everything is easy for nature, as I have said,[66] especially what she has determined to do from the start and tackles not unexpectedly but with due warning. Already from the first day of the world, when it separated out from formless unity into its present structure, the date when the earth would be drowned was decreed; and so that in the future the effort should not be difficult, as with an unfamiliar task, the seas have long been practicing for it. (2) Do you not see how the waves attack the shore as though they were going to break out? Do you not see how the tide crosses its boundaries and leads the sea forward to possess the land? Do you not see how it is perpetually battling against its confinement? And what is more, do you only need to be afraid where you can see turmoil—in the sea, and in rivers that burst out with a great quantity of breath? (3) Has nature not put water everywhere, so that she could attack us from all sides when she wanted? If people who dig up the ground do not encounter moisture, and if, whenever either greed sends us underground or some other motive compels us to penetrate deeper, the digging is not halted by water, then I am a liar. Add that there are enormous hidden lakes, a great expanse of buried sea, a great many rivers flowing unseen. (4) So the causes of the deluge will come from all sides, since some waters flow under the earth, others flow round it; they have long been restrained, but they will be victorious, and will merge rivers with rivers, lakes with swamps. Then the sea will fill the mouths of all the springs, and enlarge them with wider openings. Just as our stomach drains the body through diarrhea, just as our energy turns into sweat, so the earth will be liquefied, and, even when other causes come to a halt, it will find within itself the resources to be drowned. But I should prefer to believe that every cause will combine.

(5) Destruction will not be long delayed: harmony is being tested and disrupted. As soon as the world lapses slightly from its current requisite level of watchfulness, instantly water will burst in from

all sides, from visible and hidden sources, from above, from below. (6) Nothing is so violent, so lacking in self-control, so defiant and hostile to its constraints, as a great mass of water. It will exploit the freedom it is granted, and, under nature's orders, it will fill all it destroys and envelops. As fire that breaks out in different places soon combines in an inferno as the flames race to join together, so in a moment the seas that well up in different places will join forces.

(7) The waves will not enjoy this license for ever. Once the destruction of the human race is complete, along with the elimination of the wild animals whose characters human beings had acquired, then once again the earth will absorb the water, once again it will force the sea to stay put and rage within its boundaries. The ocean will be thrown out of our territory and driven into its hiding places, and the old order will be restored. (8) Every kind of animal will be created again, and earth will acquire human beings who are unacquainted with wickedness and born under better auspices. But even their innocence will not last except while they are newly formed. Wickedness soon creeps in. Virtue is difficult to discover; it needs a guide and leader; vice is learned even without a teacher.

On the Nile

(praef.1) You are delighted with Sicily—so you write, Lucilius, excellent man—and with the duties of a procuratorship that leaves you leisure time; and that delight will continue, if you are willing to keep the duties within their limits and not treat a procuratorship as a governorship. I have no doubt that you are willing. I know how disinclined to ambition you are, how at home with leisure and study. Let those who cannot endure their own company yearn for the bustle of activity and people; you are on excellent terms with yourself. (2) It is not surprising that this is granted to few of us: we bully and pester ourselves;[1] sometimes we suffer from self-love, sometimes from self-loathing; now we inflate our wretched minds with arrogance, now we swell them with desire, at other times we weary them with pleasure or consume them with anxiety. The worst of it is that we are never on our own; so, inevitably, there is constant quarrelling in this great brotherhood of wrongdoing.

(3) So, my dear Lucilius, do what you habitually do: keep yourself apart from the crowd, as far as you can, so that you do not expose your flank to the flatterers.[2] When it comes to attacking their superiors, they are professionals. Even if you are really on your guard, you will not be a match for them. Yet believe me: if you are caught out, it will be because you betray yourself. (4) Ingratiating behavior has this characteristic: even when it is rejected, it gives pleasure; often after being spurned, it is eventually welcomed back. For it claims credit for the very fact that it is repudiated, and not even abuse can subdue it. What I am about to say is incredible but true: each person is most exposed where he is protected.[3] (5) So train in the knowledge that you cannot achieve invulnerability. When you have taken every precaution, a blow will penetrate your armor. One person will use flattery secretly, sparingly; another openly, publicly, with pretended gaucheness, as though it were naïveté, not skill. Plancus,[4] who was the greatest expert before Vitellius,[5] used to say that there should be no concealment or dissembling in flattery. "Blandishments are wasted if hidden," he said. (6) When the flatterer is caught, he is making

excellent progress, and even better if he is rebuked, if he blushes. Realize that in your position you will encounter many Plancuses, and that being unwilling to be praised is no remedy against such dangers. Passienus Crispus is the most acute person I have known on any and every subject,[6] and especially on distinguishing and describing different kinds of fault. He often used to say that we do not close the door against flattery but push it to, and do so rather as a door is often shut against a girlfriend: if she forces it open she endears herself to us, and even more so if she breaks it down.

(7) I remember Demetrius,[7] an excellent man, telling some powerful freedman that he found an easy path to wealth on the day he repented of his good intentions. "I shall not begrudge any of you this skill," he said. "But I shall teach those who need an income how they do not have to endure the uncertainties of the sea or the lottery of buying and selling, nor to try out the unreliable world of farming, or the more unreliable one of politics; I'll teach how they can make money not just easily but enjoyably, and can rob victims who relish it. (8) I shall swear," he said, "that you are taller than Annaeus Fidus and Apollonius the boxer, even though you have the physique of a monkey matched with a Thracian.[8] When I say that no one is more generous than you, I shall not be lying, since you could be regarded as having given everyone everything you have let them keep."

(9) That is how it is, my dear Lucilius:[9] the more open flattery is, the more brazen it is, the more it wipes away its own blushes and causes other people's, then the swifter its victory. Our madness has got to the stage where someone who is sparing with flattery is regarded as mean. (10) I used to tell you about my brother Gallio[10]—whom nobody loves sufficiently, not even someone who could not love him more. He was unacquainted with other faults, but hated this one. You probed his defenses on every side. You started to express your admiration for his intellect, superior to anyone else's and fully deserving to be treated with reverence rather than with contempt: he ran away. You started to praise his simple lifestyle, which recoiled from the spirit of our age without seeming either to share it or to condemn it: he interrupted after a few words. (11) You started to compliment his friendliness and his unaffected charm, which captivated people even in passing, a kindness he bestowed freely on people even in chance encounters (no human being is as dear to any one person

as he was to everybody, although at the same time—so great is the power of natural goodness when it has no whiff of artificiality or pretence—everybody gave himself the credit for the kindness shown to all): but at this point too he resisted your flattery, so that you exclaimed that you had discovered a man who was impregnable against the ambushes that everyone lets into his heart. (12) You declared that you admired this wisdom of his, this perseverance in avoiding an unavoidable evil, and you did this all the more forcefully since you hoped you would be heard with open ears, even though what you said was flattering, because what you said was true. But he realized he must resist all the more; for falsehood always seeks to bolster its authority with truth. I do not want you to be dissatisfied with yourself, as though you acted a part badly, and as though he suspected some lack of seriousness or some trickery. He did not catch you out but repulsed you.

(13) Model yourself on his example. When some flatterer approaches you, say, "Please take those words, which now pass from one magistrate to another accompanied by lictors,[11] and present them to someone who wants to hear whatever you say and is ready to reply in kind. I neither wish to deceive nor am capable of being deceived. I should like to be praised by you if you did not also praise bad people."

What need is there to descend to the level where they can attack you from close quarters? Keep a big gap between you. (14) When you want to be praised properly, why should you be in debt to anybody else? Praise yourself! Say, "I devoted myself to liberal studies. Although poverty urged otherwise and directed my talents toward instant rewards for study, I turned aside to unremunerative pursuits: I applied myself to poetry and to the beneficial study of philosophy. (15) I showed that virtue can find a place in every heart; I escaped the confines of my birth, measuring myself on the basis not of my fortune but of my mind; I stood on a par with the greatest. Gaius did not rob me of my loyalty in my friendship with Gaetulicus, and Messallina and Narcissus, public enemies for a long time before they became enemies of each other, could not overturn my resolve in the case of other people whom I held in ill-fated affection.[12] I risked my neck for loyalty; no word was extracted from me that could not be uttered with a good conscience. For my friends I was full of fears, for

myself I had none, except that I might not have been a good enough friend. (16) No womanly tears flowed from me; I did not kneel in entreaty clutching anyone's hands; I did nothing inappropriate for a good person or a man. Rising above the dangers facing me, ready to advance against those that threatened, I thanked fortune that she had wanted to test how highly I valued loyalty. Something so important was not going to come cheaply to me. I did not spend long (for they were not of equal weight) balancing up whether it was preferable for me to die for loyalty or loyalty for me. (17) I did not rush impetuously into an extreme course of action[13] so that I could escape the madness of the powerful. At the court of Gaius I used to see torture, I used to see fire. I knew that under him human existence had already deteriorated to the point where those who were killed were held up as examples of mercy. Still, I did not fall on my sword or leap into the sea with my mouth gaping wide, to avoid it seeming that all I could do for the sake of loyalty was die." (18) Add also that your mind remained unconquered by gifts, and in the midst of all that greedy competition your hand was never held out for gain; add the frugality of your lifestyle, the decency of your conversation, your kindness toward inferiors, and your respect for superiors. After this ask yourself whether your account is true or false: if it is true, you have been praised before an eminent witness; if false, you have made a fool of yourself without a witness.

(19) Perhaps it now seems that I too am either attacking or testing you. Believe whichever you like, and be afraid of everyone, beginning with me. Listen to the well-known line of Virgil, "Loyalty is not safe anywhere,"[14] or of Ovid, "Where the earth extends, the wild Erinys reigns: you would think they had conspired to be wicked,"[15] or of Menander (for who has not galvanized his great talents to address this topic, out of loathing for the human race's universal inclination toward wrongdoing?): he says that everybody lives wickedly—the poet has leaped onto the stage like a rustic—and he makes no exception for old people, or boys, or women, or men; and he adds that it is not individuals who sin, nor small groups, but now crime is intertwined <with crime>.[16]

(20) So one must flee and retreat into oneself, or better still, actually retreat *from* oneself. Although we are separated by the sea, I shall try to perform this service for you: I shall grasp hold of you[17]

at once and lead you to something better. And so that you do not feel lonely, I shall join in conversation with you from here. We shall be together in the best part of us;[18] we shall exchange advice that is not conditioned by the hearer's expression. (21) I shall draw you far away from your province to ensure that you do not think you can place too much trust in history and do not begin to be pleased with yourself whenever you think, "I have under my jurisdiction this province, which has both supported and crushed the armies of the most powerful cities, when it lay between Carthage and Rome as the prize in a great war;[19] the province saw the forces of four Roman leaders,[20] that is of the whole empire, brought together in one spot, and it fed them;[21] it raised up Pompey's fortunes, exhausted Caesar's, handed over Lepidus's, and found room for all their fortunes; (22) it witnessed that great spectacle from which mortals could see clearly how swift is the fall from highest to lowest, and by what varied means fortune destroys great power. For at one and the same time it saw Pompey and Lepidus cast down in different ways from the topmost pinnacle to the depths, when Pompey fled from someone else's army, Lepidus from his own."

(1.1) So that I can get you completely away from there, even though there are many marvels within Sicily and nearby, for the moment I shall bypass all the questions associated with your province and shall draw your thoughts elsewhere. For I shall investigate with you the topic I postponed in the previous book,[22] why the Nile floods as it does in the summer months. Philosophers have reported that the Danube has similar characteristics, since its source is unknown and it is fuller in summer than in winter. (2) Both claims have turned out to be false: for we have discovered that its source is in Germany, and that it does start to rise in summer, but at a time when the Nile still remains at its usual level, as the hot weather is first beginning, and the fiercer sunshine is melting the snows before the end of spring. But all the snow has disappeared before the Nile starts to rise. For the rest of summer, the level of the Danube falls; it returns to its winter level and drops below it. But the Nile rises in the middle of summer, <not> before the rising of the Dog Star;[23] and it is still in flood after the equinox.

(2.1) This is the most famous of the rivers that nature has exhibited to human eyes. She has arranged for it to flood Egypt in the

period when the earth is scorched most fiercely by the heat and soaks up the water more deeply, all set to drink enough to compensate for the annual drought. For in the region that borders on Ethiopia, the rains are either nonexistent or infrequent and of no help to a land that is unfamiliar with rainwater. (2) As you know, Egypt rests its hopes on this river alone: the fertility or barrenness of the year is in proportion to the generosity or meanness of its flow. "None of the ploughmen looks at the sky": why should I not tease my favorite poet and inflict on him his favorite poet,[24] Ovid, who says "nor does the grass pray to Jupiter of the Rains"?[25]

(3) If the place from which it begins to rise could be discovered, the causes of its rising would also be found. As things stand, after meandering through vast deserts, sprawling out into marshes, and being dotted with huge <islands>, around Philae for the first time it keeps together instead of wandering erratically. Philae is a rocky island, steep on every side. It is encircled by two rivers on the point of merging into one; they change into the Nile and bear its name.[26] The whole island accommodates a city. (4) From here the Nile is broad rather than violent; it leaves Ethiopia and flows past the desert, which is crossed by the route used for trade with the Indian sea. The river is greeted by the Cataracts, a location famous for its magnificent spectacle. (5) There the Nile surges up among high crags that are sheer at many points, and increases its violence. For it crashes over the rocks it encounters, struggles through narrows, and, wherever it is winning or losing, it seethes. There its waters are whipped up for the first time, when previously it had brought them without disturbance down a gently sloping riverbed. Violent, raging, it rushes forward through resentful channels. It no longer resembles itself, for up to now its flow has been muddy and cloudy. But once it has struck the rocks and sharp crags, it foams, and its color derives not from its own nature but from the mistreatment it receives there. Finally, after battling through the obstacles, it is left hanging and suddenly plunges down a huge drop with an enormous din that fills the neighboring regions. A tribe settled there by the Persians could not endure it, since their ears were deafened by the continuous roar, so they moved to quieter parts.

(6) Among the marvels associated with the river, I have heard of the unbelievable daring of the local inhabitants. They get into tiny boats in pairs, with one of them steering, the other baling the boat

out. Swirling around amid the rushing frenzy of the Nile and the rebounding waves, they eventually reach very narrow channels that enable them to escape through the rapids. Swept along with the entire river, they control the careering boat by hand, and, to the great terror of the spectators, they plummet headfirst; and when you have given them up for lost and have supposed that they have sunk and drowned in that vast mass of water, they are sailing far from the spot where they fell, as if they had been catapulted. The waterfall does not drown them but transports them into calm water.

(7) The first sign of the rise of the Nile is seen near the island I have just mentioned, Philae. A short distance from there the river is divided by a crag: the Greeks call it Abaton,[27] and no one except the priests treads on it. Those rocky outcrops experience the initial rise in the river level. Then, after a considerable distance, two rocks protrude—the local inhabitants call them the veins of the Nile; from them a great quantity <of water> gushes out, but not enough to cover Egypt. When the traditional festival comes around, the priests throw offerings, and the prefects throw gifts of gold into the mouths of this stream. (8) From this point on, the Nile clearly possesses new vigor, and it flows in a deep, high-sided channel, prevented from expanding outward by the mountains hemming it in. Near Memphis it is at last free, and wanders over the plains, dividing into several rivers. It branches out across the whole of Egypt in artificial canals, so that the volume can be controlled by the irrigators. Initially it splits into channels, then the waters merge and spread like a wide, muddy sea. The breadth of the area over which it extends robs it of its speed and violence, as it embraces the whole of Egypt to right and left. (9) Hopes for the year are determined by the height to which the Nile rises. The farmer's calculations do not disappoint him, since the land fertilized by the Nile responds to the level of the river. It brings both water and soil to the sandy, dry earth. Since its current is turbulent, it leaves all its sediment behind on the dry, cracked land, and any fertile material it carries with it is smeared over the parched land. It assists the fields for two reasons, both because it floods them and because it coats them with mud. So any land it does not wash over remains barren and desolate. If it rises higher than it ought, it causes damage.

(10) So the character of this river is remarkable, because, while other rivers wash away and gut the land, the Nile, so much larger

than the rest, far from eating away or eroding the ground, on the contrary adds strength to it, and the least significant thing about it is that it controls the moisture of the soil; for by importing mud it soaks and binds together the sand, and Egypt owes to it not just the fertility of the land but the land itself. (11) It is a most beautiful sight once the Nile has poured across the fields. The plains are hidden, the valleys are covered, and the towns stand out like islands. There are no communications between the people living inland except by boat, and the less people see of their land, the more delighted they are. (12) Even while the Nile remains between its banks, it discharges into the sea through seven mouths. Any of these you care to choose is a large river; and even so it fans out in many <not> inconsiderable branches[28] toward different parts of the coast.

The Nile produces creatures equal to sea creatures both in size and in harmfulness. Its scale can be judged from the fact that it accommodates huge animals with sufficient food and with space for them to move around. (13) Balbillus,[29] an excellent man, exceptionally refined in every branch of literature, tells of the following occurrence when he himself was prefect in charge of Egypt. In the Heracleotic mouth of the Nile, the largest of <the seven>, he saw the spectacle of, as it were, a set-piece battle between dolphins coming in from the sea and crocodiles from the river moving against them in a column. The crocodiles were defeated by the gentle creatures with the harmless bites. (14) The upper part of their body is hard and impenetrable even to the teeth of larger animals, but the underneath part is soft and tender. The dolphins dived and, with the spines they have sticking out from their backs, wounded this part, splitting it open as they pushed against it. When a number of them were torn apart in this way, the rest, as it were, about-turned and fled—a cowardly creature when faced with a bold one, though very bold when faced with a timid one! (15) The inhabitants of Tentyra get the better of them not through any unique advantage of race or birth, but through fearlessness and recklessness. For they go after them, lasso them as they flee, and haul them in. Many perish, the ones who are less alert in the pursuit.

(16) Theophrastus reports that the Nile once flowed with sea water.[30] It is well known that, when Cleopatra was queen, it did not rise for two years in a row, in the tenth and eleventh years of her reign.[31]

They say that this was a sign of the end for two rulers: for Antony and Cleopatra's power did come to an end. Callimachus reports that in earlier centuries the Nile did not rise for nine years.[32]

(17) Now I shall proceed to investigate the causes of the Nile's rising in summer, and I shall begin with the earliest writers. Anaxagoras says that melted snows run from the mountains of Ethiopia right down to the Nile.[33] All of antiquity shared the same view: Aeschylus, Sophocles, and Euripides[34] relay it. But it is shown to be false by several arguments. (18) First, the burnt color of the people demonstrates that Ethiopia is very hot, and so do the Trogodytae, whose homes are under ground. The rocks are boiling hot, as if heated by fire, not just at midday, but toward evening too; the dust is burning hot, not allowing people to walk on it. Silver becomes unsoldered, the joints in statues melt, anything with a decorative metal plating loses that outer layer. Also the south wind, which comes from that region, is the hottest wind. None of the animals that hibernate in winter ever goes into hiding; even in winter snakes are on the surface and in the open. Even at Alexandria, which is a long way from the extreme heat, it never snows; further inland there is no rain. (19) So how can a region exposed to such intense heat have enough snow to last throughout the summer? To be sure, some of the mountains there too may have snow—but more than the Alps, more than the Thracian mountain ranges or the Caucasus? Yet the rivers from these mountains rise in spring and early summer, but then are lower than in winter; for in the springtime the rains melt the snow, and the first warm weather disperses the rest of it. (20) Neither the Rhine, nor the Rhone, nor the lower Danube, nor the Cayster at the foot of Mount Tmolus swell in summer; yet they too have very deep snow, as is natural in northerly mountains.[35] The Phasis too would rise in the same period, and the Borysthenes, if snow could produce full rivers despite the summer. (21) Besides, if this were the explanation for the rise of the Nile, it would be at its fullest in early summer; for that is when the snows are still largely intact and in a very soft state, starting to melt. But the Nile floods for four months, and its level remains steady.

(22) If you believe Thales,[36] the etesian winds[37] oppose the downward flow of the Nile and arrest its course by driving the sea into its mouths: so it rebounds and flows back on itself. It does not grow

in volume, but halts when prevented from exiting; it builds up and bursts out in the first direction it can.

Euthymenes of Massilia presents his evidence:[38] "I have sailed on the Atlantic," he says. "The Nile flows from there, and is fuller during the season of the etesian winds;[39] for then the sea is driven inland by the force of the winds. When they have abated, the ocean settles down, and the Nile flows down from there with less volume. Also, the sea tastes fresh, and the wild animals resemble those on the Nile." (23) Why then, if the etesians spur on the Nile, does its rising begin before them, and also continue after them? Besides, it does not rise higher the more strongly they blow, and it is not slowed down or speeded up depending on their force, which would happen if its rising were caused by their influence. What about the fact that the etesians batter the coast of Egypt, and the Nile flows down in the opposite direction to them, but it would need to come from the same direction as they do if it originated with them? Also, it would flow clear and blue from the sea, and not in the muddy state in which it arrives. (24) Add that his evidence is contradicted by a host of witnesses. At that period there was scope for telling lies; since foreign regions were unknown, it was possible for people to give fictitious reports. But now the entire Atlantic coast is skirted by the ships of traders, and none of them talks about the start of the Nile or a sea with a different taste; in the nature of things this is incredible, because the sun draws out all the freshest and lightest material.[40] (25) Besides, why does it not rise in winter? The sea can be stirred up by winds then as well, and by rather stronger ones; for the etesians are moderate. If the river came from the Atlantic, it would cover Egypt all at once; as things are, it rises gradually.

(26) Oenopides of Chius says that heat is confined below ground in winter;[41] consequently caves are hot, and the water in wells is warmer, and so veins of water are dried up by the internal heat. In other countries rivers are swollen by rain, but the Nile dwindles because it is not supported by any rain. Then it rises in summer, when the interior of the earth is cold and springs recover their chill. (27) But if this were true, all rivers would rise in summer, and all wells would be full of water in summer. Then it is wrong to say that it is hotter underground in winter. So why are caves and wells warm? Because they do not let the cold air in from outside. So they do not acquire heat, but keep the cold out. They become cold in summer for

the same reason, because they are remote and isolated and the hot air does not reach them.

(28) Diogenes of Apollonia says,[42] "The sun attracts moisture to itself. The dried-up earth draws it from the sea and from other sources of water. It is impossible for part of the earth to be dry and part full of water: for everything is pierced by passages and interconnected, and the dry parts draw on the wet ones. Otherwise, if the earth acquired no <liquid>, it would have dried up. The sun attracts moisture from everywhere, but especially from the regions where its heat is intense: they are in the south. (29) When the earth becomes dry, it draws more liquid to itself. Just as in lamps the oil flows to where it is being burnt, so water heads in the direction in which the force of the heat and the sweltering earth invites it. Where does it draw it from? Well, of course, from the regions where it is always winter. The north overflows with water: that is why the Black Sea constantly flows swiftly into the Mediterranean, not with tides flowing backward and forward like other seas, but always heading in one direction, with a powerful current. If it were not the case that everywhere had its deficit restored or its surplus discharged through hidden channels, everywhere would be either dry or flooded by now." (30) I should like to ask Diogenes why, since everything is permeable and interconnected, rivers do not rise in summer in every region. "The sun bakes Egypt more intensely: therefore the Nile rises higher. But in other countries as well there is some rise in the river levels." Then why is any region of the earth without water, since every region draws it to itself from other regions, and in greater quantity the hotter it is? And why does the Nile have fresh water, if it comes from the sea? For no river tastes fresher . . .

[*At this point the text breaks off in the manuscripts, and the rest of the book is lost. However, John the Lydian, a Greek author of the fifth to sixth centuries, gives an abbreviated paraphrase of chap. 2.17–30, and the immediately following section of his work, which is translated below, probably paraphrases and summarizes lost portions of Seneca's book.*[43]

Herodotus[44] says that the sun draws moisture from all the rivers as it traverses the southern zone close to the earth, but when it turns north toward summer, it calls on the Nile, and for this reason it floods in summer.

The Egyptians say that the etesians drive all the clouds from further north toward the south, and when heavy rains fall there, the Nile surges up.

Ephorus of Cyme,[45] in the first book of his *Histories*, says that Egypt is naturally porous, and each year it is covered over with mud brought down by the Nile, and in the hot season the river flows over the lighter, more porous regions like sweat.

But Thrasyalces of Thasos says that the etesians make the Nile flood:[46] for Ethiopia is circled by mountains that are high in comparison to ours, and when it receives the clouds that are driven by the etesians, the Nile flows out.

Callisthenes the Peripatetic[47] reports in book four of his *Greek History* that he went on campaign with Alexander of Macedon, and when he was in Ethiopia, he discovered that the Nile flows down from the endless rain that occurs there.

But Dicaearchus in his *Tour of the World* thinks that the Nile flows from the Atlantic sea.[48]

Opinions about the Nile are varied, but so far the truth has eluded us humans. According to the proverb, "Certainty is hidden deep."]

On Clouds, <Rain, Hail, Snow>

[*The first part of this book is missing in our manuscripts. From references in the surviving chapters, we know that the missing chapters discussed dew, frost, hail, and snow (cf. 4b.3.6; 13.2), and doubtless also clouds and rain; and Anaxagoras was mentioned (cf. 4b.3.6). There may also be traces of the missing part of the book in an anonymous medieval work (see Hine, "Seneca and Anaxagoras in Pseudo-Bede's* De mundi caelestis terrestrisque constitutione," Viator *19 (1988): 111–28).*]

(3.1) . . . if I assure you that hail is produced in the same way as ice is produced at our level, when the entire cloud is frozen, I will be behaving too recklessly. So count me as one of those second-rank witnesses, who say they did not see anything.[1] Or I too shall behave like the historians: after they have told as many lies as they like, they are unwilling to vouch for one particular detail, but add, "The authority for this will rest with the sources." (2) So if you do not really believe *me*, Posidonius will guarantee you his authority both for what has been said and for what is to follow. For he will assure you, just as though he had been there, that hail is produced from a cloud that is already watery and turning to liquid. (3) The reason for its roundness you could discover even without a teacher, once you have noticed that drops always form a sphere. That can be seen on mirrors that collect moisture when someone breathes on them, and on cups that get splashed, and on any other kind of smooth surface. Likewise if drops cling to leaves, they assume a rounded shape.

(4) What is harder than rock? What is softer than water?
Yet hard rocks are hollowed out by soft water.[2]

Or, as another poet says, "The fall of a drop hollows out a stone."[3] The hollow that is produced is itself round, from which it is clear that the thing that does the hollowing is similar: for it carves out for itself a place with its own shape and form. (5) Besides, even if the hail was not this shape originally, it can become round as it falls, and, as it rolls over and over during its descent through a motionless expanse of dense air,

it can be worn down evenly to a spherical shape. This cannot happen to snow, because it is not as solid, or rather because it is loose-textured; and it does not fall from a great height, but starts out near the earth. So its descent through the air is not lengthy but localized.

(6) Why should I too not allow myself the same liberty as Anaxagoras allowed himself?[4] Equal freedom ought to exist among philosophers more than any other group. Hail is nothing other than ice in suspension; snow is suspended frost. For we have already said that the difference between dew and water is the same as the difference between frost and ice, and also as that between snow and hail.[5]

(4.1) I could dismiss myself, with the inquiry completed, but I shall give good measure, and since I have begun to annoy you, I shall address all the inquiries that people make on this topic. They inquire why in winter there is snow but not hail, and why hail falls in spring, when the cold weather has already lost its grip. To confess the truth to you, I am <easily> persuaded; I guarantee to be gullible enough to believe those less serious lies for which people generally get their face slapped, not their eyes gouged out. (2) In winter the air is cold and so does not yet turn to water, but to snow, which is closer to air. When spring begins, a greater change in the air ensues, and in the warmer sky larger drops are formed. So, as our Virgil says, "when showery spring pours down,"[6] there is a more vigorous transformation of the air, which spreads and expands in all directions, helped by the warmth. So the rain showers that fall are heavy and widespread rather than prolonged. (3) In winter, rain is lingering and slight, such as often occurs when light, fine rain has snow mixed in with it; we talk about a snowy day when it is very cold and the sky is overcast. Also, when the north wind is blowing or dominating the weather, the raindrops are fine; in the south wind the showers are more violent and the drops fuller.

(5.1) There is a point made by our people that I dare not either mention, since it seems flimsy, or omit. But what harm is there in writing something for a more lenient judge too? Indeed, if we start applying strict quality control to all our arguments, silence will be in order. For few of them go unopposed, and the rest, even when they win, still have to contest the case. (2) Our people say that in spring in the region of Scythia and the Black Sea and the north, everything that has been iced up and hard starts to thaw; then frozen rivers

start to move, then blanketed mountains melt their snows. So it is plausible that cold currents of breath come from there and mix with the spring sky. (3) They also add a point that I have not put to the test, and am not thinking of doing so—you also, I suggest, if you want to investigate the truth, should test the snow on a Carian:[7] they say that people walking on firm, hard snow get less cold feet than people walking on soft, slushy snow. (4) So, if they are not mistaken, everything that comes from the northern regions once the snow is breaking up and the ice is cracking binds and constricts the air in the south, which is already warm and moist. So what would have been rain turns to hail when assaulted by the cold.

(6.1) I cannot stop myself from going on to expose all the follies of our people. They declare that some people are expert at observing clouds and predict when hail is going to occur. They could have learned this by experience, when they noted the cloud color that was always followed by hail. (2) What is incredible is that at Cleonae there were publicly appointed *chalazophulakes*,[8] people who watched out for hail coming. When they had given a signal that hail was imminent, what do you suppose? That people ran for their cloaks or their waterproofs? No, they all performed their own sacrifices, one person with a lamb, another with a chicken. Instantly those clouds turned away, once they had tasted a bit of blood. (3) That makes you laugh? Listen to what will make you laugh even more. If anyone had neither a lamb nor a chicken, as an inexpensive alternative he turned on himself, and, so that you do not think clouds are greedy or cruel, he pricked his finger with a really sharp stylus and performed a sacrifice with the blood. The hail turned away from his tiny farm no less than from those where it had been appeased with larger victims.

(7.1) They try to find an explanation for this. Some of them, as is appropriate for people of their great wisdom, deny the possibility of anyone bargaining with hail and buying off storms with little gifts—even though gifts win over the gods as well.[9] The others say they suspect that the blood itself contains some force capable of diverting and repelling a cloud. (2) But how could such a tiny amount of blood contain a force great enough to reach so high and have an effect on the clouds? How much easier to say, "It's a lie, it's fiction." But the people of Cleonae used to grant permission for those who were assigned the task of forecasting storms to be brought to trial on the

charge of allowing the vineyards to be battered or the crops flattened through their negligence. In our society too the Twelve Tables[10] have a clause forbidding anyone from putting a spell on another person's crops. (3) The uneducated people of old believed that rain could be both attracted and repelled by incantations. It is so evident that all this is impossible that you need not attend any philosopher's school to learn it.

(8) I shall add one further point, and then you will want to cheer and clap.[11] They say that snow is produced in the region of the sky that is close to the earth. For this contains more heat, for four reasons: one, that every evaporation from the earth, since it contains a lot of hotness and dryness, is warmer the more recently formed it is; secondly, that the sun's rays rebound from the earth and run back on themselves: this doubling of their force warms things that are close to the earth, which contain more heat because they feel the sun twice over; the third reason is that the higher regions are more windswept, and anything lower down is buffeted less by the winds. **(9)** In addition to these there is Democritus's explanation:[12] "The more solid a body is, the more quickly it absorbs heat, and the longer it retains it. So if you leave a bronze vessel, a glass one, and a silver one in the sun, heat will enter the bronze one more quickly and will stay there longer." He then goes on to say why he thinks this happens. "Bodies that are harder and more compressed," he says, "must contain smaller passageways, with more rarefied breath in each of them. It follows that, just as smaller baths and smaller boilers warm up more quickly, so these hidden, invisible passageways both feel heat more swiftly, and because of that same narrowness give off more slowly what they have received."

This long introduction is leading up to the topic under investigation. **(10)** The closer any air is to the earth, the denser it is. Just as in water and any kind of liquid the sediment is at the bottom, so in the air too the most concentrated bits sink to the bottom. It has already been demonstrated that the denser and solider the material anything is made of, the more staunchly it preserves the heat it has received. The more distant the upper air is from the filth of the earth, the purer and clearer it is; so it does not retain the sun's heat but passes it on as if through a vacuum. Therefore it does not become so warm.

(11.1) Against this, some people say that mountain tops ought to be warmer, the closer they are to the sun. They seem to me to be mistaken in thinking that the Apennines and the Alps, and other mountains famous for their exceptional height, rise so high that their size can feel the closeness of the sun. (2) They are high so long as they are being compared with us; but when you look at the universe, the modest height of all of them is evident. They are outdone by, or outdo, each other, but none rises high enough for even the greatest of them to have any significance in comparison to the whole universe. If this were not so, we would not say that the whole earth is a ball. (3) The properties of a ball are roundness and a degree of evenness. You must realize that this is the evenness you see in balls used in games: the seams and the cracks do not really prevent them from being described as equal in every direction. Just as in this kind of ball those gaps are no obstacle to its appearing round, in the same way lofty mountains are no obstacle in the case of the whole earth either; their height is swallowed up in a comparison with the whole world. (4) Anyone who says that a higher mountain, because it receives the sun's rays from a closer position, ought to be warmer, may as well say that a taller person ought to be warmed more quickly than a tiny person, and the head more quickly than the feet. But anyone who measures the world on its own scale, and considers that the earth occupies just a pinprick, will realize that nothing can project far enough from the earth to feel the influence of the heavens more strongly, as though it had got closer to them. (5) Those mountains that we look up at, and those peaks covered with perpetual snow are nevertheless at the bottom; a mountain is closer to the sun than a plain or valley, but in the same way as one hair is thicker than another. On that basis, one tree will also be said to be closer to the heavens than another; which is false, since there cannot be a big difference between tiny things, except in comparison with each other. When it comes to comparison with an enormous body, it makes no difference how much bigger one is than the other, because even if the difference is great, still minimal things are being outdone <by other minimal things>.

(12) But to return to the topic, for the reasons I have given, most people think that snow is produced in the part of the air that is adjacent to the earth, and that it is less tightly bound together because

it is formed by less severe cold. The adjacent air is both too cold to turn into water and rain, and not cold enough to harden into hail. In this moderate, not-too-intense cold, snow is formed as the water is compacted.

(13.1) "Why," you ask, "do you pursue so energetically these absurd inquiries, which make a person more learned, not more virtuous? You tell us how snow is formed, though it is much more important to us that you tell us why snow should not be purchased." Are you instructing me to bring an action against luxury? That is a daily struggle, and a fruitless one. But let us bring the action all the same; even if luxury is going to win, let it overcome people who are fighting and struggling. (2) Tell me now, do you think that this investigation into nature has no bearing on what you are looking for? When we ask how snow is formed and say that it resembles frost, that it contains more breath than water, do you not think it is a rebuke to people if, given that buying water is shameful, what they are buying is not even water? (3) Let us inquire into how snow is formed rather than how it is preserved; since, not content with bottling wines and arranging our wine cellars by flavor and age, we have found ways of packing snow so that it can overcome the summer and be protected against the heat of the season by the coldness of its location. What have we achieved by these efforts? Well, obviously, that we trade in water, even though it is free. We are unhappy that we cannot pay for breath or for sunshine, that the air is readily available without payment even to the refined and the wealthy. O how hard done by we are, that nature has let anything remain readily available! (4) She wanted this stuff to flow and be accessible to everyone, she has made it publicly available for all living beings to drink, she has poured it out generously and abundantly for both humans and wild beasts, birds, and the idlest of animals to use. But luxury, inventive to its own detriment, has given it a price tag. You see, absolutely nothing can please luxury unless it is expensive. This was the one thing that reduced the wealthy to the same level as the masses, the one thing in which they could not outdo the poorest. For the person who is burdened by wealth a way has been devised for even water to accommodate luxury.

(5) I shall explain how we reached the point where no flowing water seemed cold enough for us. As long as the stomach is healthy, can take wholesome food, and is filled, not stuffed, it is satisfied

with natural palliatives. When it is burnt by daily indigestion and feels not the heat of the weather but its own heat, when continual drunkenness has established itself in the inner organs and is scalding the digestive system with the bile that it forms, inevitably something is sought to mitigate that feverishness, which is just intensified by water. The remedies only exacerbate the illness; and so, not just in summer, but in the middle of winter too, for the same reason, they drink snow. (6) What is the reason for this if not diseased intestines and digestive systems ruined by overindulgence? They are never given any pause for rest: after dinners lasting till dawn, lunches are stuffed in, and when they are bloated with the quantity and variety of the courses, partying sends them into deeper decline. Then the unremitting self-indulgence, which has already overcooked their minds, drives what is left of them into a state of frenzy and inflames them with longing for something ever colder. (7) So, although they insulate the dining room with curtains and windowpanes, and tame the winter with plenty of fires, nevertheless that stomach, weakened and enfeebled by its own heat, seeks something to revive it. For just as we sprinkle cold water on people who have fainted or are in a daze, so that they may recover their senses, so their internal organs, dulled by their vices, can feel nothing unless you shock them with extreme cold. (8) That is why, I tell you, they are not satisfied even with snow, but they seek out ice, as though, being solid, its coldness were more reliable, and they constantly pour on water to melt it. The ice is not taken from the surface, but, in order that it may have greater power and more enduring coldness, it is dug out from deep down. So there is not even a standard charge, but water has its traders and (the shame of it!) a scale of prices. (9) The Lacedaemonians banished perfume-sellers from their city and ordered them to leave their territory quickly because they were wasting olive oil. What would they have done if they had seen workshops for storing snow, and all those pack animals employed to transport water, whose color and taste they taint with the chaff with which they protect it?

(10) But, good gods, how easy it is to quench a healthy thirst! Yet what feeling can those throats have when they are deadened and callused by burning food? Just as nothing is cold enough for them, so nothing is hot enough, but they gulp down blazing hot mushrooms, hastily dipped in their seasoning, and virtually smoldering, only to

extinguish them with snow-cooled drinks. You will see, I tell you, some skinny creatures, wrapped in a Greek tunic and scarf, pale and ill, not just sipping snow but actually eating it, and dropping lumps of it into their cups to prevent them growing warm in the gaps between drinking. (11) Do you think this is thirst? It is a fever, all the more severe for not being detected by feeling the pulse or by heat spreading over the skin; but luxury, an unconquerable evil that develops from soft and pliant to hard and enduring, overcooks the heart itself. Do you not realize that everything loses its force with familiarity? So that snow of yours, in which all of you actually swim now, has come, through regular use and the daily slavery of the stomach, to occupy the place of water. Look for something even chillier than snow, because coldness, once you have got used to it, is worth nothing!

On Winds

(1.1) Wind is flowing air. Some people have defined it as follows: wind is air flowing in one direction. This definition looks more thorough, because air is never so motionless as to be free from all turbulence. Thus the sea is called calm not <when it is ruffled by no turbulence at all, but> when it is moving only slightly, and is not tending in one direction. So if you read, "when the sea stood still and calm in the wind,"[1] be aware that it is not standing still but rippling gently, and it is called calm because it is not heading in this direction or that. (2) One must take the same view about air too, that it is never motionless even if it is still. You may infer this from the following observation: when sunlight pours into an enclosed space, we see tiny particles moving in different directions, some up, some down, and colliding chaotically. (3) So anyone who says "A wave is a motion of the sea" will not be conveying his meaning carefully enough, because calm sea is also in motion; but he will have thoroughly covered himself if his definition is "A wave is a motion of the sea in one direction." In just the same way, on the subject we are investigating at the moment, no one will be outwitted if he makes a point of saying, "Wind is air flowing in one direction," or "air flowing with an impact," or "a mass of air moving in one direction," or "air rushing somewhere very swiftly." (4) I know the response that could be made in favor of the original definition: "Why need you add air flowing 'in one direction'? For anything flowing is automatically flowing in one direction. No one says that water is flowing if its movement is just internal, but if it is traveling somewhere. So something can move and not flow, and conversely it cannot flow except in one direction." (5) Well, if this brief version is sufficiently protected against captious objections, let us use it, but if someone is more cautious, he should not hold back from adding a phrase that can prevent any quibbling. Now let us move on to the real business, since we have argued enough about the form of words.[2]

(2) Democritus says that when there are many particles, which he calls atoms, in a confined empty space, the result is a wind;[3] on

the other hand, the air is in a peaceful, still state when there are few particles in a large empty space. "In a marketplace or street, so long as there are few people, one can walk without interference, but when a crowd converges in a confined area, there is quarrelling as people bump into each other. In exactly the same way, in the space surrounding us, when many particles have filled a small region, inevitably they bump into each other, push forward and get pushed back, become entwined and get forced together. This generates wind, when the particles that were wrestling with each other move off and, after long turmoil and hesitation, choose one direction. But when there are few particles moving in a large empty space, they cannot be jostled or pushed."

(3.1) That this is false you may infer merely from the fact that wind occurs least of all when the air is dense with cloud. Yet then many particles have converged in a confined space, and this produces the dense mass of thick clouds. (2) Add that near rivers and lakes there is often a mist, as particles are packed and massed together, yet there is no wind. Sometimes such darkness envelops us that we lose sight of people standing close to us, which would not happen unless many particles forced their way into a small space. Yet no conditions are freer of wind than mist. (3) Add that, on the contrary, what happens is that the sun when it rises rarefies the thick, moist morning air; breezes spring up when the particles are given room and their congestion and crowding is dispersed.

(4.1) "So how do winds occur," you ask, "since you reject that explanation?" In more than one way: sometimes the earth itself emits a large quantity of air and breathes out from deep within; sometimes when strong, continuous evaporation from its surface has driven the emissions upward, the struggles of these heterogeneous exhalations turn to wind. (2) The following idea is one I cannot be persuaded either to believe or to suppress: in our bodies food produces flatulence, which causes considerable offence to our noses as it is emitted, sometimes relieving the bowels noisily, sometimes more discreetly; they think that, in just the same way, this immense natural system emits breath as it processes its nourishment. It is just as well for us that it always has good digestion; otherwise we should have something rather disgusting to be afraid of. (3) Is it perhaps truer to say that many particles are constantly being given off from every part of

the earth? When they have been packed together and then begin to be thinned out by the sunshine, since everything that expands in a narrow space wants more room, a wind springs up.

(5.1) But wait a minute: do I think that this is the only cause of wind, evaporation from water and land? Does this produce denseness in the air, which is then loosened by <the sun's> impact, when what had been tightly packed inevitably struggles to find a broader space as it expands? I certainly think this is one explanation of wind, but the following is a much more powerful and truer one: air has a natural ability to move; it does not acquire it from any external source, but has an innate capacity for movement, among other things. (2) Do you think that *we* have been given strength to move ourselves, but the air has been left inert and immobile, even though water possesses its own motion even when the winds are still? Otherwise it would not produce living creatures; and we also see moss growing in water and grasslike plants floating on the surface. Therefore water has some vital power. (6) Am I talking just about water? Fire, which consumes everything, creates certain things, and—this seems incredible, but it is true—living creatures are generated by fire.[4] So air possesses some vital power, and consequently at one moment it makes itself dense; at another it expands and purifies itself; sometimes it contracts; <at other times> it spreads out and expands.

So the difference between air and wind is the same as that between a lake and a river.[5] Sometimes the sun itself is the cause of wind, spreading out cold air and expanding it from a dense, compact state.

(7.1) We have spoken about winds generally; now let us begin to discuss them individually. Perhaps it will be clear how they are formed if it is clear when and from where they come. So first let us examine the predawn breezes that come either from rivers, or from valleys, or from some depression. (2) None of these is persistent, but they die down when the sun gets stronger, and do not travel out of sight of land. This kind of wind begins in spring, does not last beyond summer, and comes especially from places with a lot of water and mountains. Flat regions, even if they have plenty of water, do not have breezes—I mean those that count as winds.

(8.1) So how is the kind of air current that the Greeks call *encolpias* produced?[6] The emissions given off by marshes and rivers (they

are both abundant and continuous) by day nourish the sun,[7] but at night they are not used up, and when enclosed by mountains, they collect in one spot. When they have filled it and no longer have enough room, they are forced to go somewhere, and they advance in one direction: this is a wind. So it follows the invitation of a more accessible exit and an empty space that the accumulated material can rush into. (2) There is proof of this in the fact that the wind does not blow during the first part of the night. Then the concentration is only beginning to form, but by daybreak it is already full and congested, and is looking for somewhere it can flow to; and it particularly makes for where there is a lot of empty space and a large, open area. It is spurred on by the sunrise striking the cold air; for even before the sun is visible, its light is strong, and though it is not yet propelling the air with its rays, still it is already arousing and provoking it with the light it sends on ahead. (3) Once the sun itself has emerged, some material is drawn upward, some is scattered by the heat. So these winds are not allowed to flow beyond the dawn period; all their force is extinguished by the sight of the sun. Even if they have been blowing more violently, they still slacken around midday, and the breeze never lasts right up till noon. Some of these breezes are weaker and briefer <than others>, according to the strength or weakness of the material whose accumulation generates them.

(9.1) Why are such winds stronger in spring and summer? (They blow very lightly in the rest of the year, too weakly to fill sails.) Because spring is wet, and there is more evaporation from rainwater and from places that are water-logged and flooded because of the damp state of the atmosphere. (2) But why do they blow just as strongly in summer? Because the heat of the day continues after sunset, and lasts for most of the night: this draws out the emerging exhalations and extracts more vigorously what is usually given off spontaneously; but then it does not have enough strength to consume what it has drawn out. Therefore there is a longer period during which land and water are emitting the particles that are regularly emanating and being exhaled. (3) Sunrise produces wind not just with its heat but also with its impact. For, as I have said,[8] the light that precedes the sun does not yet heat the air but only strikes it; and when struck it moves sideways. However, I would not actually agree that the light itself has no heat, since it is derived from heat. (4) Perhaps it does

not have enough heat for us to feel it, but it does its job and expands and rarefies dense things. Besides, places that through some unfairness on nature's part are so enclosed that they can get no sunlight are nevertheless warmed by their cloudy, gloomy light and are less chilly during the day than at night. (5) Also, all heat naturally drives away and repels mists; therefore the sun too does the same, and so, some people think, the air current comes from the direction of the sun. **(10.1)** That this is false is clear from the fact that a breeze can blow in any direction, and ships can go toward the sunrise under full sail; which could not happen if wind always came from the sun.

The etesian winds,[9] too, which some people invoke as evidence, do not help their thesis much. (2) I shall first say what these people think, then why I disagree. "There are no etesian winds in winter," they say, "because during the very short days the sunlight comes to an end before the cold is overcome; so snow both settles and lasts. They begin to blow in summer when the days last longer and also the sun's rays fall on us vertically. (3) So it is likely that the snows, when hit by this great heat, exhale more moisture, and also that the earth, once unburdened of the snow and exposed, breathes more freely. Thus more particles come from the northern region of the sky and travel down to the regions that are lower and warmer; that is how the etesians acquire their force. (4) For that reason, they start at the solstice and do not last beyond the rise of the Dog Star,[10] because by then a lot of material from the cold region of the sky has been discharged into this region, and the sun, reversing its direction, moves to the south, where it is more directly overhead, and draws one part of the air toward itself, but drives the other part forward.[11] So the blowing of the etesians breaks the force of the summer and protects against the oppressiveness of the hottest months."

(11.1) Now, as I promised, I must say why the etesians do not help us and do not contribute to the explanation of this kind of breeze. We have said that the breeze is spurred on before daylight,[12] and then dies down when the sun touches it. Yet the etesians are called sleepy and self-indulgent by sailors, because, in Gallio's words,[13] "they can't get up in the morning"; they start to emerge roughly at the time when even the longer-lasting breezes have stopped. This would not happen if the sun set them in motion as it does the breeze. (2) Add that if the reason for their blowing were the length and duration of the day, they

would blow before the solstice as well, when the days are very long and when the snows are melting most rapidly. For by July everything is laid bare, or certainly very little is still lying under snow.

(12.1) There are some kinds of wind that are emitted by clouds that burst and disintegrate in a downward direction: the Greeks call these winds *eknephiai*.[14] They are produced as follows, in my view. There is great inequality and dissimilarity among the particles that are emitted by the heat of the earth and rise high in the sky: some of these particles are dry, some moist. There is a great commotion as the particles fight each other when they are gathered into a single mass, and as a result it is likely that some hollow clouds are formed, and that gaps are left between them, tubular and narrow like a reed-pipe. (2) Rarefied breath is trapped in these gaps, and, having no clear path, when it is buffeted, it grows hot and looks for a larger space. This makes it expand; it tears apart whatever envelops it, and it bursts out as a wind. This is generally squally, because it is propelled downward from above, and falls on us powerfully and sharply; for it is not spread out and does not have a clear passage, but struggles and makes a path for itself in a violent battle. It is usually a short gust, because it bursts through the enclosures in the clouds through which it was moving, and through the clouds' defenses. So its arrival is stormy and sometimes accompanied by fire and noise from the sky.[15] (3) These winds are much more powerful and longer lasting if they also gather up other air currents that have been produced in the same way and are racing along, and if many of them unite in a single flow; just as torrents are of modest size as long as they each have their own separate channel, but when they have absorbed the waters of many others, they exceed the size of regular, perennial rivers. (4) It is plausible that the same happens with squalls too: that they are short-lived as long as they are on their own; but when they have joined forces, and breath ejected from many regions of the sky has all headed in the same direction, there is an increase in both their power and their duration. (5) So a disintegrating cloud produces wind, and it can disintegrate in many ways: sometimes a concentration of breath bursts it, sometimes the wrestling of breath trapped inside and struggling to escape, sometimes heat, produced on occasion by the sun, on occasion by the jostling and mutual friction of particles moving erratically.

(13.1) At this point, if you agree, we can ask how a whirlwind is produced. In the case of rivers it commonly happens that so long as they move unimpeded, their course is simple and straight; but when they run into some rock or a projecting section of the river bank, they are violently deflected, and whirl their waters round in circles without any way out; the result is that they are swallowed up in themselves as they rotate and form a vortex. (2) In the same way wind, so long as there are no obstacles, gives its energy free rein; but when it is deflected by some prominence, or is forced into a sloping, narrow channel <in a slender gap> between converging land-masses, it wheels round on itself repeatedly, and produces a vortex similar to the whirling water we have described. (3) This wind that revolves and circles on the same spot and whips itself up as it spins is a whirlwind. If it is more aggressive and spins for longer, it catches fire and produces what the Greeks call a *prester*: that is, a fiery whirlwind. Virtually all the perils that tear away rigging and lift entire ships up in the air are the result of winds that burst out of clouds.

(4) Also, some winds generate further winds and drive and scatter the air in directions different from the one they themselves have been taking. I shall say something else that occurs to me too: drips of water, even though they are already poised and threatening to fall, have not actually fallen yet; but when several of them converge and gain strength from their numbers, then they are said to flow and move; in just the same way, as long as there are only slight movements of disturbed air in various places, there is not yet a wind; the wind starts when it has blended them all together and merged their momentum into one. A breath differs from a wind in degree: for a more powerful breath is a wind, and conversely a breath is air flowing gently.

(14.1) I shall now repeat what I said at the start,[16] that winds are emitted from caves and recesses within the earth. The earth does not consist entirely of a solid structure reaching right down to its foundations, but in many parts it is hollow and "suspended above dark hiding-places."[17] <In some places it has abundant water,> in others it has empty spaces without any liquid. (2) Although down there no light reveals differences in the air, I shall nevertheless state that in the darkness there are clouds and mists. For even in the case of those above the earth, they do not exist because they are seen, but they are seen because they exist: below ground too, they do not exist

any the less because they are not seen. You may be sure that down there rivers as big as our own are flowing, some of them moving gently, others crashing noisily over rocky rapids. And tell me, will you not equally grant that there are some lakes beneath the earth as well and some stagnant waters without an outlet? (3) If this is so, it is also inevitable that the air becomes heavy, and, when heavy, it pushes forward and stirs up a wind with its pressure. We shall also be sure that air currents generated by those subterranean clouds are nurtured in the darkness until they have enough strength either to sweep away the resistance of the earth, or to seize some passageway that is available for these emissions of air and to emerge through that cavern into where we live. (4) It is obvious that beneath the earth there is a great quantity of sulphur and of other substances that feed fire just as well. When the breath that is seeking a way out hurtles through these areas, it must ignite a fire with the friction; then as the flames spread out wider, even if some of this air was sluggish, it must expand and move and look for a channel with enormous noise and energy. But I shall develop this topic in more detail when I am investigating earthquakes.[18]

(15.1) Now let me tell a story. Asclepiodotus[19] writes that a number of men were sent by Philip down an old mine that had long since been abandoned;[20] they were to explore how rich its deposits were, what state it was in, whether past greed had left anything for future generations. They descended with plenty of lights, enough to last many days; then, when exhausted by the long journey, they saw enormous rivers and huge lakes of stagnant water, like our own, not cramped by the earth weighing down on them, but with plenty of open space—and they could not help shuddering at the sight. (2) I read this with great pleasure. For I realized that our generation is struggling with vices that are not new but inherited from long ago; in our day it was not the first time that greed had rummaged in the veins of earth and rock and searched in the darkness for what was inadequately concealed. Those ancestors of ours whom we are constantly praising, whom we complain that we so little resemble, were led on by their hopes to hack into mountains, and stood on top of their gain, beneath their ruin.[21] (3) Before King Philip of Macedon there were people who would pursue money into the very deepest recesses, and, though endowed with upright,[22] free spirits, would stoop

to enter those caves where no contrast between night and day ever penetrated. What great hope made them leave the daylight behind? Human beings stand erect, facing the stars, so what great necessity made them bend down, buried them, and plunged them to the depths of the earth's interior, to dig out gold that is no less dangerous to search for than to possess? (4) For its sake they dug tunnels and crawled after their grubby, undependable plunder, forgetting the daylight, forgetting the better world on which they had turned their backs. Does the earth lie as heavy on any corpse as it did on those people,[23] over whom great greed threw the weight of the earth, whom it robbed of the sky, whom it buried in the depths where that foul poison lurks?[24] They were bold enough to descend to where they encountered a new natural order: earth suspended above them, winds blowing aimlessly in the darkness, grim springs of water flowing for no one's benefit, and deep, endless night. Then when they have done that, they are afraid of the underworld!

(16.1) But to return to the subject under discussion, there are four winds, distributed in the east, west, south, and north. The rest, which we call by various names, are associated with these.

> The east wind has retreated to the dawn and the kingdom of
> the Nabataeans
> and Persia and the mountains beneath dawn's rays.
> The evening and the shores that are warmed by the setting sun
> are closest to the west winds. Scythia and the Plough[25]
> are occupied by the chilling north wind; the opposite region
> is drenched by constant cloud and the rainy south wind.[26]

(2) Or if you would rather list them more briefly, let them gather in a single storm (something that is quite impossible):

> both east and south wind rush together, and the African wind,
> laden with storms,[27]

and the north wind, which had no part in that quarrel.

(3) Some people think there are twelve winds. They divide each of the four sections of the sky into three, and give each wind two subordinates. Varro,[28] a careful scholar, arranges them in this fashion, and not without good reason. The sun does not always rise or set in the same place,[29] but the rising and setting at the equinoxes

(of which there are two), at the summer solstice, and at the winter solstice, are all different. (4) The wind that blows from the equinoctial rising point is called *subsolanus* by us,[30] and the Greek name for it is *apheliotes*. *Eurus* comes from the winter solstitial rising, and our fellow countrymen have named it *uolturnus*. Titus Livius[31] calls it by this name in that battle that did not go well for the Romans, in which our army was drawn up facing both the rising sun and the wind, and Hannibal defeated us with the help of the wind and of the brightness that dazzled his enemies' eyes. Varro employs this name as well, but now *eurus* too has been granted citizenship, and is no foreigner when it crops up in our language. The wind coming from the summer solstitial rising the Greeks call *kaikias*, but we have no name for it. (5) The equinoctial setting sends us *fauonius*, which even people who know no Greek will tell you is *zephyrus*. *Corus* comes from the summer solstitial setting; some people call it *argestes*. I disagree, because *corus* is violent, and sweeps things along in one direction, but *argestes* is normally gentle and equally useful to people sailing in either direction. From the winter solstitial setting, the African wind, which rages and rushes, is called *lips* by the Greeks. (6) On the north side the most important place goes to *aquilo*,[32] the middle one to *septemtrio*, the lowest to *Thraikias*:[33] we have no name for this one. In the south there is *euronotos*; then *notos*, *auster* in Latin; then *leukonotos*, for which we have no name.

(17.1) It is thought that there are twelve winds not because there are that many everywhere (for some are shut out by the earth's contours), but because nowhere are there more. Thus we talk of six cases[34] not because every noun has six, but because none has more than six. (2) Those who have said there are twelve winds have taken the view that the number of winds corresponds to the number of the sectors of the sky. The sky is divided into five circles that pass through the key divisions of the world: there is the arctic circle, the tropic of Cancer, the equatorial circle, the tropic of Capricorn, and the antarctic circle. In addition there is a sixth that divides the upper part of the world from the lower; for as you know, half of the world is always above us, half below. (3) This line between the visible and the hidden [that is this circle] the Greeks call the *horizon*, our countrymen have called it the delimiter, or others the delimiting circle.[35] One must also add the meridian circle, which intersects the horizon at right angles. Some of

these circles run at an angle and intersect the others as they encounter them. There must be partitions in the air corresponding to each of these sections. (4) Thus the horizon or delimiting circle intersects those five circles I have just described and creates ten sections, five in the east, five in the west. The meridian circle, which meets the horizon, adds two regions. Thus the air has twelve partitions and produces as many winds.

(5) Certain winds are unique to certain places and do not travel far but blow locally. They do not rush in from the edge of the whole world: *atabulus* plagues Apulia, *iapyx* Calabria, *sciron* Athens, *crageus* Pamphylia, and *circius* Gaul. When this last one destroys buildings, the local population nevertheless give thanks, on the grounds that they owe the healthiness of their climate to it. The deified Augustus certainly vowed and built a temple to it when he spent time in Gaul. It would be never-ending if I wanted to go through these winds individually: for there is virtually no region without some breeze that springs up in it and dies down close by.

(18.1) Among the other works of providence, this also may be regarded as worthy of admiration: providence did not devise winds or distribute them in different locations for one reason alone, but, first, so that they would not allow the air to grow stagnant, but by constant agitation would make it beneficial and life-giving to those who would be breathing it; (2) next, so that they might supply the land with rain and at the same time prevent an excess of it. For one moment they bring clouds, the next they drive them away, so that rain can be shared out across the entire earth. The south wind drives them to Italy, the north wind forces them back to Africa. The etesians do not allow clouds to settle in our region; they also water all of India and Ethiopia with continuous rain during that period. (3) And just think: grain could not be harvested if the redundant material mixed in with what needs to be kept were not winnowed out by an air current, if there were not something to make the crops grow and to burst open their wrappings (farmers call them husks) and reveal the grain hidden inside! (4) Just think how wind has given all nations communications with each other and brought together peoples separated by geography! An enormous kindness of nature's, if the folly of humans did not pervert it to their own harm! As things are, what was commonly said about Gaius Marius, and was recorded by Titus Livius,[36]

that it is uncertain whether it was more in the state's interests for him to be born or not to be born, can also be said about winds. For their useful and essential effects cannot match what the madness of the human race devises to its own ruination. (5) But those benefits do not cease to be intrinsically good just because they cause harm through the fault of those who misuse them. It was not for this that providence and the god who manages the world gave the winds the task of keeping the air moving and poured out winds from all directions to prevent anything becoming desolate through neglect—it was not so that we could cram armed soldiers into fleets that would take control of a large part of the sea, nor so that we could search for an enemy on the sea or beyond the sea.[37] (6) What madness drives us on and sets us against each other to our mutual destruction? We spread sails to the winds to look for war; we court danger for the sake of danger; we risk the fickleness of fortune, powerful storms that no human resources can overcome, and death with no hope of burial. (7) It would not be worth the cost if after all this we arrived at peace: as it is, when we have got past all the hidden reefs and the traps set by shallow seas, when we have escaped towering, stormy mountains from which wind hurtles down and smashes into seafarers, when we have escaped daylight shrouded in cloud and nights wild with downpours and thunder, when we have escaped ships torn apart by whirlwinds, what profit will we get from this effort and fear, what port will welcome us when we are exhausted by all these sufferings? War, of course; an enemy waiting for us on the shore; races destined to be slaughtered and to bring down most of their conquerors with them; and ancient cities in flames! (8) Why do we drive nations to arms? Why do we enlist armies to draw up their battle lines amid the waves? Why do we disturb the seas? I suppose the land is not extensive enough for all our deaths! Fortune pampers us too much, has given us over-resilient bodies and blessed good health! Misfortunes do not attack and devastate us! Each of us can measure out our years in comfort and sprint home to old age! So let us head for the seas and call the neglectful fates down on our own heads!

(9) Wretched people, what are you looking for? Death, which is abundantly available everywhere? It will fetch you from your beds, but make sure you are innocent when it fetches you; it will seize you in your homes, but make sure you are plotting no evil when it seizes

you. What else could it be called but insanity, to carry danger around with you and attack unknown people, to be angry without being wronged, to destroy everything in your path, and to kill someone you do not hate, as wild animals do? Yet animals bite either in retaliation or through hunger: without sparing our own blood or anyone else's, we put our hands to work, we launch ships, we entrust our safety to the waves, and we pray for favorable winds—and for us success consists in being transported to war. (10) How far our wrongdoings have brought us! Madness within one's own part of the world is not enough. That is why the king of Persia,[38] stupid man, will cross over to Greece; his army will not defeat the country even though it has filled it. That is why Alexander will want the regions beyond the Bactrians and the Indians, and will try to find out what lies beyond the great sea,[39] and will be aggrieved that he meets a dead end. That is why greed will deliver Crassus to the Parthians;[40] he will not tremble at the curses of the tribune who calls him back, nor at the storms on the long sea voyage, nor at the prophetic lightning-bolts and hostile gods by the Euphrates; he will face the anger of men and gods to reach gold.

(11) So it would not be unreasonable to say that nature would have treated us better if she had banned the winds from blowing, had prevented madmen from rushing off in all directions, and had ordered everyone to stay in his own land. Then, if nothing else, each person's birth would bring evil only on himself and his own people. But as it is, domestic evils are not enough for me; I must suffer foreign ones as well. (12) No land is so remote that it cannot export some evil of its own. How do I know whether at this moment some obscure lord of a great people, puffed up by fortune's kindness, is no longer confining his armed forces to his own territory, whether he is building fleets, pursuing unknown plans? How do I know whether this wind or that is bringing me war? Shutting down the seas would be a large contribution to human peace.

(13) Yet, as I was saying a short while ago,[41] we cannot complain about god our maker if we have corrupted his good gifts and made them the opposite. He gave the winds to control the temperature of the sky and the earth, to elicit and restrict the flow of water, to nurture the fruit of crops and trees. This is brought to ripeness, along with other causes, by shaking in the wind, which draws nourishment

up to the top of the plants and keeps them moving to prevent wilting. (14) He gave the winds to enable exploration of distant regions: for human beings would have been ignorant creatures, without much experience of the world, if they were confined by the boundaries of their native soil. He gave the winds so that the benefits of each region would be shared, not so that they could convey legions and cavalry, nor so that they could transport the destructive armies of the nations. (15) If we measure nature's benefits according to the depravity of those who use them, we have received all of them to our detriment. What good does sight or speech do anyone? Who does not find life a torment? You will discover nothing of such manifest usefulness that it cannot be turned into the opposite by wrongdoing. So nature devised winds as well to do good: we ourselves have made them do the opposite. (16) They all lead us into some evil. Each person has a different reason for setting sail, but none has a sound one. We are driven by various temptations to brave the sea; the voyage inevitably serves some vice. It is a fine saying of Plato, whom we must now call as a witness near the end, that the things people purchase with their lives are trivial.[42] What is more, my dearest Lucilius, if you correctly assess their madness—which means ours, since we are floundering in the same crowd—you will laugh even more when you reflect that the very things on which lives are wasted are acquired for the sake of life.[43]

On Earthquakes

(1.1) We have heard, Lucilius, excellent man, that Pompeii, the busy Campanian city, has been ruined by an earthquake, and all the neighboring areas have been badly affected. The coasts of Surrentum and Stabiae on the one side, and of Herculaneum on the other, meet at the city, encircling the open sea, which there retreats inland in a charming bay. This event happened during winter too, a period that our ancestors used to promise us was free from such dangers. (2) Campania had always been nervous of this threat, but had remained unharmed and had many times got over its fears; but this earthquake, occurring on February 5 [in the consulship of Regulus and Verginius],[1] devastated all of the region and caused great destruction. For part of the town of Herculaneum collapsed too, and even what remains is standing precariously. The colony of Nuceria, though spared catastrophe, is not spared complaints. Naples, too, has lost many private buildings, though no civic ones, being only lightly affected by the vast tragedy. Country houses have collapsed or have often been shaken without damage. (3) In addition to this, a flock of hundreds of sheep was killed, and statues were split apart; afterward some people wandered around in a state of shock and deranged.[2]

Both the plan of the work I have embarked upon and the coincidence of this recent disaster call for a discussion of the causes of earthquakes. (4) Comfort needs to be found for the fearful, and their great terror needs to be eradicated. For what can anyone regard as sufficiently secure, if the world itself is shaken, and its firmest parts crumble; if the one thing in it that is immovable and fixed, so that it supports everything that converges on it, starts to waver; if the earth has lost its characteristic property of standing still? Wherever will our fears find rest? What shelter will our bodies find, where will they escape to in their anxiety, if the fear arises from the foundations and is drawn from the depths? (5) There is general panic when buildings rumble and their collapse is signaled.[3] Then everyone rushes straight outside, abandons his home, and entrusts himself to the open air. What hiding place can we see, what help, if the earth itself cracks,

and the very thing that protects and supports us, that cities are built on, that some have called the foundation of the world, gapes open and trembles? (6) I do not say what help, but what comfort can you find, when fear has lost every means of escape? What, I say, is sufficiently fortified, what is firm enough to protect anything else or even itself? I shall drive an enemy back from the wall, and high, sheer fortresses will delay even large armies with the difficulty of approaching them; a harbor rescues us from a storm; roofs keep out torrential downpours and rain that falls incessantly; fire does not pursue those who run from it; underground houses and deeply dug caves are protection against thunder and threats from heaven (that heavenly fire does not penetrate the earth, but is quenched by a thin covering of it);[4] in a plague one can move home. No disaster is without an escape. (7) Lightning-bolts have never burnt up whole peoples; a plague-ridden atmosphere has emptied cities but has not destroyed them. But this disaster spreads far and wide, inescapable, greedy, harmful on a national scale. For it does not swallow up just individual homes or households or cities: it overwhelms entire peoples and regions, sometimes covering them in ruins, sometimes burying them in deep chasms. It does not even leave evidence to show that what exists no more did once exist, but the soil spreads over the noblest cities without any trace of their former state.

(8) There is no shortage of people who are more afraid of this manner of death, in which they fall into the abyss with their homes and are carried off alive from the ranks of the living; as though not every kind of death reached the same destination. This is one outstanding feature of the justice of nature, that when it comes to death, we are all on equal terms. (9) So it makes no difference whether a single stone crushes me, or I am buried by an entire mountain; whether the weight of a single house falls on me, and I perish beneath its paltry rubble and dust, or the entire earth blots out my life; whether I breathe my last in the daylight and in the open or in a huge rift in the gaping earth; whether I am carried to those depths alone or with a great company of peoples falling with me. It makes no difference to me how great a commotion surrounds my death; death amounts to the same thing everywhere.

(10) So let us face this disaster bravely—it can be neither avoided nor foreseen—and let us stop listening to those who have given up

on Campania and have emigrated following this catastrophe, who say they will never come near the region again. For who promises them that this or that bit of land rests on better foundations? (11) Everywhere shares the same condition, and, if not yet shaken by an earthquake, still it can be shaken. Perhaps this spot on which you are standing too confidently will be torn apart tonight, or today before nightfall. How are you to know that the places in which fortune has already used up her power, those that from now on are supported on their own ruins, are not in a better state? (12) We are wrong if we believe that any part of the earth is exempt and immune from this danger: everywhere lies under the same law; nature has created nothing to be immovable. Different parts collapse at different times, and just as, in large cities, at one moment this house is verging on collapse, at the next moment that one, so, in the earth, at one moment this part is damaged, at the next moment that one. (13) Tyre was once notorious for earthquake destruction; Asia lost twelve cities simultaneously; last year this disastrous force, whatever it is, attacked Achaea and Macedonia; now it has damaged Campania. Fate goes round in circles, and if it has missed something out for a while, it goes back to it. It harasses some places more rarely, some more often. It allows nothing to be immune and unharmed. (14) Not only we humans, who are born short-lived, frail creatures, but cities, and the coasts and shores of the land, and even the sea, are enslaved to fate. And yet we promise ourselves that all the blessings of fortune will last, and we believe that someone will find that happiness, which of all human possessions is the most fleeting and fickle, has substance and permanence. (15) When people promise themselves that everything will last for ever, it never occurs to them that the very thing we stand on is not durable. For it is a defect not of Campania or Achaea, but of every piece of ground, that it holds together only loosely; it is weakened by many causes, and while the whole endures, parts collapse.

(2.1) What am I doing? I had promised comfort in the face of dangers that are infrequent, and now look, I am warning that everywhere there are things to be feared. I say there is no such thing as endless peace: what can decay can also destroy. But I regard this fact itself as a comfort, and a very powerful one, since incurable fear <rescues> the foolish. Reason can dispel terror from the wise, but in the ignorant, desperation leads to a great sense of calm. (2) So regard

the following words, which were spoken to those people stunned by their sudden captivity, amid fire and enemies, as spoken to the human race: "The only rescue for the defeated is to expect no rescue."[5] (3) If you want to be afraid of nothing, regard everything as something to be afraid of. Look around and see what trivial things can destroy us: not even food, not liquid, not waking, not sleeping, is beneficial except in moderation. Now you will realize that we are mere bodies, insignificant and frail, fleeting, destined to be destroyed with no great exertion. Without doubt this is the only danger we face, that the earth quakes, that it is suddenly shattered and drags down the things on its surface! (4) The person terrified of lightning-bolts, earthquakes, and subsidence is very self-important! He should be aware of his own frailty and be afraid of phlegm![6] But of course we are born like this, assigned such successful bodies! We have grown to such a stature! So are we incapable of dying unless whole sections of the world are shaken, unless the heavens thunder, unless the earth collapses? (5) Pain in a fingernail, and not even in all of it, but a cut at the side of it, can finish us off! Should I be afraid of earth tremors when thickened saliva can suffocate me? Should I panic at the sea emerging from its sea-bed, at the prospect of the tide rushing in further, bringing more water than usual and overwhelming me, when some people have been choked by a drink that went down the wrong way? How foolish to tremble at the sea when you know you could be killed by a drop of water!

(6) There is no greater comfort in the face of death than mortality itself, none in the face of all those external terrors greater than the fact there are countless dangers here inside us. For what is crazier than fainting at the sound of thunder and crawling below the earth from fear of lightning-flashes? What is more foolish than being afraid of <the earth's> swaying or of the sudden collapse of mountainsides and invasions of the sea as it races beyond the shoreline, when death is present everywhere and can attack from anywhere, and nothing is too tiny to be able to bring destruction to humankind? (7) Those things should not upset us, as though they contain more suffering than an ordinary death, far from it; rather, since we have to depart this life and to breathe our last at some time or other, we should be glad if our death has a grander cause. We have to die somewhere, sooner or later: even if this soil stands firm, remains within its confines, and is not

shaken by any harmful force, sooner or later it will cover me. <What> difference does it make whether I spread it over me or it does so itself? (8) Suppose it is split and shattered by the immense force of I know not what evil, and it drags me down to an immeasurable depth: what of it? Is death easier on the level? What grounds for complaint have I if nature does not want me to succumb to an ignoble demise, if she buries me beneath part of herself? (9) My friend Vagellius says in splendid fashion, in that famous poem of his, "If I have to fall, I should like to fall from heaven."[7] In the same way one can say, "If I have to fall, may I fall while the earth is shaken," not because it is right to wish for a public disaster, but because it is a great comfort in the face of death to see that the earth too is mortal.

(3.1) It will also help to realize in advance that the gods are not responsible for any of this, and neither the sky nor the earth is shaken by the anger of divinities:[8] these things have their own causes, and do not run wild to order, but, like our bodies, they are upset by certain defects, and when they seem to be *causing* harm, they are *suffering* it. (2) When we are ignorant of the truth, everything is more terrifying, especially when rarity increases the fear. Familiar things affect us less severely, but alarm caused by something unusual is more intense. Yet why do we find anything unusual? Because we grasp nature with our eyes, not our reason, and we do not consider what she *can* do but what she *has* done. So we are punished for this carelessness when terrified as if by something new, although it is not new but unusual. (3) But, you say, does it not fill minds with religious awe across the whole community if the sun is seen to suffer an eclipse, or if the moon, which is more frequently dimmed, disappears either partially or wholly? This is far truer in the case of torches driven across the sky, a large section of sky blazing, long-haired stars, multiple suns, heavenly bodies appearing by day, and fires suddenly darting across the sky, leaving bright trails of light behind them.[9] (4) We never marvel at these things without fear. Since the cause of the fear is ignorance, is it not worth acquiring knowledge in order to remove your fear? How much more worthwhile it is to investigate causes, with your whole mind focused on this goal! For no more deserving subject can be found, and you must not simply lend your mind to it, but spend your mind on it.

(4.1) So let us investigate what it is that moves the earth deep below the surface, what disturbs such a heavy mass, and what is more

powerful than it, so that it shatters that great weight with its force; why the earth sometimes shakes, sometimes crumbles and subsides, at other times splits apart and gapes open, sometimes preserving for a long time the opening caused by its collapse, at other times swiftly closing it up again; why it sometimes diverts into itself rivers known for their great size, sometimes sends out new ones, at times opens up veins of hot water, at times makes them grow cold; and why it occasionally emits fire through some previously unknown fissure in a mountain or rock, at times extinguishes other fires that have been well-known and renowned for centuries. It produces thousands of marvels: it alters the shape of the terrain, it brings down mountains, lifts up plains, makes valleys swell up, and raises new islands in the deep. The causes of these phenomena deserve examination.

(2) "What will be the benefit?" you ask. The greatest possible benefit, the knowledge of nature. The investigation of this subject has many benefits, but none is finer than the fact that it captivates people with its own magnificence, and their motives for studying it are not gain but wonder. So let us examine the causes of these phenomena. I find this inquiry so enjoyable that, though I once wrote a book on earthquakes in my youth, I still wanted to test myself and explore whether age has added anything to my knowledge, or at least to my thoroughness.

(5.1) Some have thought that the cause of earthquakes is to be found in water, others in fire, others in the earth itself, others in breath, others in more than one of these, others in all of them. Some people have said that it is clear that one of these is the cause, but it is not clear which one. (2) I shall now examine these theories individually, but first of all I need to say that early views were rather imprecise and crude: people were still roaming in search of the truth; everything was new to the first investigators. Later those same views were refined, and if any progress was made, it should nevertheless be credited to them. It took great courage to prize open nature's hiding places, and, not content with her outward appearance, to look inside, and to immerse oneself in the secrets of the gods. Anyone who was optimistic that discovery was possible made a major contribution to the search. (3) So we should listen to the early writers indulgently. Nothing is completed while it is beginning; not just on this subject, the most important and most obscure of all (on which, even when

much has been achieved, still every generation will find something to contribute), but in every other pursuit, the starting point is always far from the culmination.

(6.1) That water is the cause has been said by more than one person, and in more than one way. Thales of Miletus[10] thinks that the whole earth rides and floats on the liquid beneath it, whether you call this ocean, or the great sea, or water of a different sort, still in its primeval form, the liquid element. "The earth is supported by this sea," he says, "like some large ship weighing heavily on the water it presses down on." (2) It is unnecessary to give the reasons why he thinks that the heaviest part of the world cannot be buoyed up by breath, which is so tenuous and fleeting; for the present discussion is not about the position of the earth but about its movement. He presents the following argument to show that water is responsible for the earth shaking: in virtually every sizeable earthquake new springs emerge; similarly in ships one finds that, if they lean over and tilt to one side, water seeps in, and if they are unduly weighed down by an excessive load of cargo, the water either washes over the ship, or at any rate comes up higher than usual on the port and starboard sides. (3) It does not take long to show that this view is false: for if the earth were supported on water and were sometimes shaken by it, it would *always* be moving, and we should not be surprised at its quaking but at its standing still. In addition, it would all be shaken, not just part of it (for one never finds half a ship being tossed by the waves); yet in fact earthquakes affect not the entire earth but part of it. So how could something, all of which is floating, not all be shaken, if it is shaken by the thing on which it is floating? (4) "But why do springs emerge?" In the first place, the earth has often trembled without any new water flowing out; next, if this were the cause of the water breaking out, it would pour over the edges of the earth (just as we see happen with rivers and the sea: when ships are sinking lower, the higher water level is most apparent at the sides); finally, the water would not emerge in such tiny quantities as you say, and would not seep through like bilge water through a crack, but there would be a huge inundation, seeing that it comes from an endless supply that supports everything.

(7.1) Some people have attributed earthquakes to water, but not by the same process. "Many types of water flow over the whole earth,"

one of them says. "In some places there are perpetual rivers, large enough to be navigable even without the assistance of rainfall: here the Nile carries huge volumes of water throughout the summer, here the Danube and the Rhine do the same, flowing in between pacified and hostile territory, the first restraining the attacks of the Sarmatians and forming the boundary between Europe and Asia,[11] the second repelling the Germans, a race keen on war. (2) Think also of very extensive lakes, of expanses of water surrounded by peoples unknown to each other, of unnavigable swamps through which even the inhabitants cannot communicate with each other; then think of all the springs, of all the river sources that unexpectedly disgorge great currents from their hiding places, then of all those rushing torrents that are formed temporarily, whose force is as brief as it is sudden. (3) Every type and form of water is also found within the earth: there too some waters are carried along in a vast current, and swirl over waterfalls; others are feebler: they spread out in shallows, and they flow gently and peacefully. Who would deny that those waters are collected in huge receptacles and in many places lie still and motionless? It does not take long to argue that there is a lot of water in the place from which all water comes: for the earth would not be capable of discharging so many rivers if it did not disgorge them from some reservoir, and a large one. (4) If this is true, it is inevitable that sometimes a river will flood within the earth, burst its banks, and violently attack anything in its way. Thus an earthquake will occur somewhere where this river has directed its onslaught and has battered away until it abated. It may happen that, as a stream flows past some region, it causes erosion, leading to the collapse of a great mass of rock, and the landslide makes things on the surface shake.

(5) "Also,[12] if people do not believe that the gulfs of a huge sea are hidden within the earth, they are relying too much on their eyesight, and do not know how to let their minds advance beyond it. For I see no hindrance or obstacle to the earth having a shore hidden within it as well, and a sea that flows in through concealed channels, one that occupies just as great an area down there, or perhaps an even larger one, since the earth's surface had to be shared with all those living creatures: what is out of sight and devoid of any occupants is more freely available to the waters. (6) What is to prevent them forming waves down there too and being whipped up by winds, which any

gap in the earth and any air can produce? So an unusually violent storm can develop, crash against some part of the earth, and cause it to shake violently. For in our world too many things that were far away from the sea have been battered by a sudden tidal wave, and breakers that were heard in the distance have inundated villas built with a sea view. Down there as well the subterranean sea can recede and then can cause an inundation; neither of which happens without an earthquake overhead."

(8.1) I do not think you will hesitate for long about whether to believe that there are subterranean rivers and a concealed sea. From where do these things emerge, from where do they come into our world, if the source of the liquid is not contained within the earth? (2) Consider: when you see the Tigris interrupted and dried up in mid-course—not diverted all at once, but gradually, first contracting with no perceptible loss, then disappearing—where do you think it goes, if not to unseen parts of the earth, especially when you see it emerging again no smaller than when it was flowing earlier? What about when you see the Alpheus, celebrated by the poets, disappearing below ground in Achaea, and then, after crossing the sea, once more issuing in Sicily as a most attractive spring [Arethusa]?[13] (3) Are you unaware that among the various theories explaining how the summer flooding of the Nile occurs there is this one: that the river gushes out of the earth and rises with water not from above but from deep within? I heard two centurions whom Nero Caesar, great lover of the other virtues and especially of truth, had sent to search for the source of the Nile. They told how they made a long journey, when they were provided with assistance by the king of Ethiopia, were given recommendations to the neighboring kings, and penetrated further inland. (4) "Then," they said, "we reached interminable marshlands. The local people had not discovered where they ended, nor can anyone hope to do so: weeds are so entangled with the water and the water <with weeds>, they are impassable either on foot or by boat; only a small, one-man craft can manage on the muddy, overgrown swamp. There," he said, "we saw two crags from which a huge volume of river water cascaded down." (5) Whether that is the source of the Nile or a tributary, whether it first emerges there or returns to the surface after being swallowed underground in its earlier course, do you not believe that this water, whatever it is,

rises from a great lake within the earth? For the earth must contain liquid, both dispersed in many places and concentrated in a single place, to be able to disgorge it with such force.

(9.1) Some people—and they are not <negligible authorities>—think that fire is the cause of earthquakes. In particular Anaxagoras thinks that both the air and the earth are shaken by very similar causes:[14] down below, dense air that is concentrated into clouds is broken up by breath, with the same force with which clouds commonly burst in our world. Fire breaks out from this collision between clouds and from the rapid movement of the ejected air, and this fire attacks everything in its way, looking for an exit. It shatters anything that resists, until it either finds a way out to the sky through some narrow channel, or violently forces its way out. (2) Other people think that fire is the cause, but not for the same reason, but because it burns deep inside the earth in many places and consumes everything in the vicinity.[15] Whenever the eroded material collapses, an earthquake results in the region, for it is robbed of its underlying supports, and it shakes until it caves in, since there is nothing there to take the weight. Then chasms and huge abysses open up. Alternatively, after long hesitation, the region settles down on top of what still remains standing. (3) We can see this happening in our own experience too when part of a city is affected by fire. When joists are burnt through, or what was supporting the upper stories is damaged, then the housetops sway for a while before collapsing; they continue to fall and remain unstable until they have come to rest on something solid.

(10.1) Anaximenes says that the earth itself causes its own quakes,[16] and nothing attacks from outside to cause the movement, but the cause is within itself and from itself. For some sections of the earth collapse when either dissolved by water, or eaten away by fire, or shattered by violent breath. But even when these forces cease, there remain factors that cause collapse or fracture. In the first place, everything is weakened by the passage of time, and nothing is secure against old age; it gnaws away at solid and extremely strong things too. (2) So just as in old buildings things collapse even without being shaken, since their weight exceeds their strength, so in the entire body of the earth it can happen that parts of it are weakened by old age, and when weakened they collapse and cause tremors on the surface. In the first place, they do so while they are breaking off

(for nothing of any size splits off without causing movement in the thing it was attached to); then, after they have fallen off, when they meet something solid, they rebound like a ball, which, when it falls, leaps back up, and bounces repeatedly, each time being propelled from the ground in a fresh trajectory; and if they fall into standing water, their fall shakes the neighboring region with the wave sent out by the sudden, massive impact of the weight crashing down from high above.

(11) Some people attribute the shaking to fire, but in a different way. Since fires are burning in many places, inevitably they give off an immense amount of hot vapor, which has no escape. It increases the tension of the breath with its energy, and, if it attacks more fiercely, it splits apart anything in its way; if it is gentler, it merely shakes it. We see water bubbling away when there is a fire below it. What fire does in the case of this small amount of enclosed water, we should suppose it does to a much greater degree when it is violent and widespread and gets huge quantities of water boiling; anything that it pushes against with the steam from this turbulent water is shaken.

(12.1) Many very distinguished writers think it is breath that causes earthquakes. Archelaus,[17] a careful investigator, says, "Winds sweep down into the cavities in the earth; then, when all the spaces are full, and the air has condensed as much as it could, any breath that comes along later pushes and crushes the air already there, and with repeated gusts it first compresses it, then catapults it forward; (2) as it searches for somewhere to go, it makes all the narrow channels wider and tries to break out of its prison. The result is that, as the breath wrestles and looks for an escape route, the earth quakes. Therefore when an earthquake is about to happen, immediately beforehand the atmosphere is tranquil and calm, the reason being that the powerful breath that normally provokes the winds is detained beneath the earth." Recently, too, when the earthquake occurred in Campania, in the days that preceded, the atmosphere was quite still, although it was wintertime, when the weather is unsettled. (3) "So, has an earthquake never occurred when a wind was blowing?" Very rarely: <for rarely> have there been two winds blowing at once; but it can and does occur. If we accept this, and we agree that two winds can operate at once, why can it not happen that one wind sets in motion the air above ground, the other wind the air below?

(13.1) You can count Aristotle as an adherent of this view, and his student Theophrastus (not, as the Greeks think, a man whose style is divine—but it is attractive and effortlessly elegant).[18] I shall expound the view they share: "There is always some exhalation from the earth, sometimes dry, sometimes mixed with moisture. This issues from deep inside and rises as far as it is able; then when it has nowhere further to advance, it reverses direction and turns back on itself. Then the conflict, as the breath moves back and forth, flings obstacles aside, and whether the breath is cut off, or it forces a way through narrow channels, it provokes movement and disturbance."

(2) Strato,[19] who belongs to the same school, specialized in this branch of philosophy and researched into natural science. His verdict is as follows: "Cold and hot always move away from each other; they cannot coexist. Cold flows into the places that hotness has left, and conversely heat is found where cold has been expelled. The truth of what I say, that these two things are driven in opposite directions, should be clear to you from the following: (3) in winter, when there is cold above the earth's surface, wells are hot, and so are caves and all kinds of hollows beneath the earth, because the heat retreats there, giving way to the cold that is in control up above. When it reaches the regions below and crams itself in as far as it is able, the denser it is, the stronger it is. But this hot air encounters <cold air that has previously gathered beneath the earth>; the cold air that has collected and been squeezed into a corner necessarily gives way to the hot. (4) The reverse happens as well: when a large amount of cold enters the caverns, any hot lurking there gives way to the cold and escapes to some confined space, driven with great force, because the natures of the two things do not allow harmony or coexistence. So, as it flees, desperate to get out at all costs, it demolishes and hurls aside everything in the vicinity. (5) Therefore before an earthquake a bellowing sound is commonly heard, as the winds fight unseen." (In the words of our Virgil,[20] in no other way could "the ground bellow underfoot and the high mountains be shaken," if this were not the work of the winds.) (6) "Then the progress of this battle is always the same: the heat gathers its forces and breaks out again; then the cold is subdued and collapses, though it will soon regain the supremacy. As these forces advance in turn, and the breath travels to and fro, the earth quakes."

(14.1) There are some who think that earthquakes are produced by breath and nothing else, but by a different mechanism from the one preferred by Aristotle. Listen to what they say. Our bodies are irrigated both by blood and by breath, which passes along channels of its own. We have some narrower receptacles for the soul, through which it does no more than move, and some broader ones, in which it collects and from which it is distributed to the various parts of the body. In the same way the entire body of the whole earth is permeated both by water, which functions like blood, and by wind, which one could simply call soul. These two things are in motion at some points and stand still at others. (2) When our bodies are in good health, the pulse rate is undisturbed and remains regular, but when there is a problem, the pulse is faster, and gasping and panting are signs of strain and exhaustion. In just the same way the earth too remains unshaken while in its natural condition, but when something goes wrong, then there is movement like that in a sick body: the breath that was flowing more moderately vibrates more strongly and shakes its veins. Nor, as those who think the earth is a living creature were saying a short while ago, <***.>[21] Unless this is so, just like an animal, it will experience equal discomfort all over; for in us fever does not strike some parts more moderately and <others more violently>, but it pervades every part with equal intensity.

(3) Consider, then, whether breath enters the earth from the surrounding air and flows without causing damage so long as it has a way out. If it encounters and bumps into something that blocks its path, then first it piles up as air pours in from behind, next it grudgingly escapes through some crevice, moving more violently the more it is constricted. This cannot occur without a fight, and a fight cannot occur without movement. (4) If it does not even find a crevice to flow out through, it accumulates and rages there, swirling this way and that, knocking over some obstacles, bursting through others; for, being very fine and yet also very strong, it even breaks through barriers put in its way, and also with its power it drives apart and shatters whatever it enters. Then the earth quakes: for either it opens up to make room for the wind, or, after it has made room, being robbed of its foundations, it collapses into the very cavern through which it let the wind escape.

(15) Some people think that the earth is perforated at many points. It does not have only those original entrances that it acquired at its creation, like breathing passages, but accidents have produced many more. In some places water has caused the earth above to sink; torrents have cut through other places; others have split and gaped open in intense heat. Breath enters through these gaps. If the sea shuts it in and drives it deeper down, and the waves do not permit it to get out again, then the breath, with both exit and retreat cut off, swirls around; and because it cannot go in a straight line, which is natural for it, it struggles upward, and splits open the earth that is pressing down on it.

(16.1) It still remains to give the view of the majority of writers, the one that will perhaps get my vote. It is plain that the earth contains breath: I do not mean just the breath that makes it cohere and keep its parts united, which is found even in rocks and dead bodies,[22] but I mean the life-giving breath that is vigorous and sustains everything. Unless it contained this, how could it instill breath into all those trees and all those plants that have no other source of life? How could it nourish all the different kinds of roots that go down into it in different ways—some growing near the surface, others sent deeper down—unless it contained a lot of soul to produce so many, varied plants and make them grow as they breathe and feed on it? (2) So far I have been using lightweight arguments. The entire heaven, surrounded by the fiery aether, the highest part of the world, all these stars, whose number cannot be reckoned, all this host of heavenly bodies, and, to omit the others, the sun, which orbits so close to us, several times larger than the entire circumference of the earth—all these draw their nourishment from the earth and share it among themselves, and are obviously sustained by nothing other than the earth's exhalation. This is their nourishment, this is their food.[23] (3) Now, the earth could not nurture so many things so much larger than itself if it were not full of soul, which it gives off from every part of itself, day and night. It must be the case that it has plenty left over, when so much is demanded and taken from it. To be sure, what is emitted is created as required (for it would not have a constant supply of breath sufficient for all those heavenly bodies unless the elements moved in a cycle and were transformed into one another), but nevertheless the earth must be full and overflowing, and must bring breath

out from its storehouse. (4) So there is no doubt that a lot of breath is concealed within it, and a broad expanse of air occupies hidden spaces beneath the earth. If this is true, then necessarily anything that is full of a very mobile substance must often be moved. For can anyone doubt that nothing is as restless as air, or as changeable, and as delighted by upheaval?

(17.1) So it follows that it exploits its own nature, and, since it wants to be constantly in motion, it sometimes moves other things as well. This occurs when its passage is barred. For as long as it is not hindered, its movement is calm; when it meets an obstacle and is held up, it goes crazy and sweeps away the obstructions, just like the "Araxes, angry at the bridge":[24] (2) as long as its channel is easy and unimpeded, it lets its waters flow onward as they arrive; but when rocks placed there by human hand or by chance check its passage, then it gains energy from the delay, and the more numerous the obstacles, the more force it acquires. For all the water builds up behind and rises in level, and, once it cannot support its own pressure, it rushes forward, gaining strength, and escapes headlong, taking the obstructions with it. The same happens with breath, which, the stronger and nimbler it is, breaks out all the more quickly and violently demolishes every barrier. This causes an earthquake, in the region, naturally, beneath which the battle has been fought. (3) The truth of this account is demonstrated by the following evidence too: often after an earthquake has occurred, if part of the earth's surface has been split open, a wind has blown from it for several days. That is what is reported to have happened in the earthquake that affected Chalcis. You will find in Asclepiodotus, a student of Posidonius [in these very causes of natural questions],[25] and you will find in other writers, too, that the earth gaped open at one point, and a wind blew from there for a considerable time. It had presumably made for itself the channel through which it issued.

(18.1) So the principal cause of earthquakes is breath, which is naturally swift-moving and constantly changing its position. As long as it is not being pushed around and is lurking in an empty space, it spreads out harmlessly and is no trouble to its surroundings. (2) When some external cause interferes and goads it on, and drives it into a smaller space, then, if it still can, it merely gets out of the way and wanders off. When it is robbed of all opportunity of leaving

and is obstructed on every side, then "with a loud rumbling from the mountain it roars around its prison walls";[26] for a long while it batters and tears and shakes them, with a ferocity matching the strength of the obstacle it has been wrestling with. (3) Then, when it has gone round examining every bit of its prison and has been unable to get out, it rebounds from the place that it has dashed against with the greatest force, and it either disperses through unseen passages, as the earthquake itself makes the earth less dense, or it bursts out through a fresh wound. That is right: such a mighty force cannot be contained, nor can any structure restrain a wind. For it undoes any fastening and carries every weight along with it; it pours through the tiniest openings to make room for itself and sets itself free by its invincible natural power, especially when it is agitated and is defending its rights. (4) Breath is indeed an indomitable force: there will be nothing to "restrain the wrestling winds and the deafening storms with its command, and curb them with chains and prison."[27] (5) Doubtless the poets wanted the place in which the winds were confined and hidden below the earth to be thought of as a prison, but they did not realize that what is confined is not yet a wind, nor that what is a wind cannot any longer be confined. For what is confined is at rest; it is stationary air: wind is always on the run.

(6) To these arguments one can add another to show that earthquakes are produced by breath. Our own bodies as well tremble only if some factor upsets the breath in them: when it contracts with fear, when it grows weak with old age and becomes feeble in sluggish veins, or when it is subdued by cold or diverted from its usual course by the onset of a fever. (7) As long as it is flowing unimpaired and moving as normal, there is no trembling in the body. But when something arises that restricts its normal functioning, then it is not strong enough to tolerate what it had been able to endure while it was healthy; it grows weak, and causes shaking in parts of the body that, when it itself was strong, it kept firm.

(19.1) Let us listen, since we must, to Metrodorus of Chius as he takes his turn to say what he thinks.[28] For I do not allow myself to omit even views that I disagree with, since it is preferable to grant all of them access and to condemn what we disagree with rather than to omit it. (2) So what does he say? "When someone sings into a large jar, his voice races round with a kind of vibration, and it reverberates;

though its initial movement is so slight, all the same the voice spreads all round, making contact with its container and creating a noise in it. In just the same way, the vast expanses of the caverns suspended beneath the earth contain their own air, which is disturbed as soon as more air invades from above and makes it vibrate; just as the empty vessels I was talking about a moment ago resound when someone shouts into them."

(20.1) Let us move on now to those who have said that all the factors I have described, or several of them, are responsible. Democritus thinks several are.[29] For he says that earthquakes are sometimes produced by breath, sometimes by water, sometimes by both, and he continues, "Some part of the earth is hollow; a great quantity of water flows into it. Part of this is light, and runnier than the rest. This is forced back when dense stuff arrives on top of it, and it crashes against the earth and makes it quake; for it cannot form waves without shaking what it dashes against." (2) Also what we were saying about breath should be applied to water too: "When it has accumulated in one spot, and there is no room for any more, it presses in one direction, opening up a path first with its weight, then with its momentum. For it cannot escape except downward, having been confined for a long time, and it cannot fall vertically in a controlled manner or without shaking what it falls through or onto. (3) Once it has begun being swept along, if at some point it halts, and the powerful current turns back on itself, it is forced back against the surrounding earth and attacks it where it is most unstable. Sometimes, too, when the earth becomes sodden as water penetrates deeply, it subsides, and its foundations are weakened. Then it gives way at the point where the weight of the sinking waters is most intense. (4) Sometimes breath drives the waves on, and if it blows very violently, it causes an earthquake in the region into which it pushes the massed water. Sometimes the breath hurtles into passages in the earth, and as it tries to find a way out, it makes everything shake. Also the earth can be penetrated by winds; and breath is too fine to be kept out and too violent to be endured when it is excited and fast-moving."

(5) Epicurus says that all these causes can operate,[30] and he tries out several others, criticizing those who have declared that just one of them is the cause, since it is difficult to guarantee certainty about topics that have to be pursued by conjecture. (6) "Therefore," he says,

"water can cause an earthquake if it has washed away and eroded parts of the earth which, once worn away, leave the earth no longer able to support the weight it could when they were intact. The impact of breath can cause earthquakes: perhaps the air is disturbed when more air enters from outside; perhaps when part of the earth suddenly collapses, it causes a shock that sets the air in motion. Perhaps part of the earth is supported by some columns and piers, as it were, and when they are weakened and worn away, the weight placed on them shakes. (7) Perhaps some hot breath that has turned to fire, like a lightning-bolt, moves forward, causing serious damage to anything in its path. Perhaps some breeze sets marshy, stagnant water moving, and then either the impact shakes the earth, or the agitation of the breath grows with its own movement, spurs itself on, and travels from the depths right up to the surface." But he thinks that no cause of motion is more important than breath.

(21.1) We too think it is breath that is capable of such great initiatives. There is nothing more powerful in nature, nothing more dynamic; without it not even the most violent things have any strength: breath ignites fire; water, if you take away the wind, is static, and only starts moving when a gust of wind propels it. Wind can break up great stretches of the earth, can raise up new mountains from below, and can establish in the middle of the sea islands that have not been seen before. Thera, and Therasia, and the island that was formed in the Aegean sea in our own day as sailors watched[31]—who doubts that breath brought them into the light of day?

(2) There are two kinds of earthquake, according to Posidonius.[32] Each has its own name: one is a shock from below, when the earth shakes and moves up and down; the other is a tilting motion, in which it rocks from side to side like a ship. I think there is also a third kind, denoted by our own term:[33] for with good reason our ancestors spoke of an earth tremor, which is different from the other two; for in it things are not shaken from below, nor tilted from side to side, but tremble, which in such cases causes very little damage, just as <***>.[34] Tilting motion is much more destructive than a shock: for unless a swift movement in the opposite direction occurs rapidly, to restore what has tilted to one side, collapse inevitably follows.

(22.1) Since these kinds of movement are different from each other, their causes are dissimilar too. So let us deal with the shaking

movement first. Whenever large loads are pulled through the streets <on a line> of several vehicles, and the wheels fall really heavily into potholes, you will feel the buildings shaking. (2) Asclepiodotus[35] reports that when a boulder broke off the side of a mountain and crashed down, nearby buildings collapsed in the tremor. The same can happen below the ground: some overhanging rock becomes detached and falls into a cavern below with great momentum and noise, and with greater violence the heavier it is or the further it falls; and thus the entire roof of the hollow depression is shaken. (3) It is also plausible not only that rocks are broken off by their own weight, but also, when rivers flow above them, the constant moisture weakens the joints in the stone, and day by day removes some of what the stone is attached to, and wears away the glue, so to speak, by which it is fastened. Then over a long period the protracted attrition so weakens what it has been eroding day by day that it ceases to be capable of load-bearing. (4) Then rocks of enormous weight fall down; then a collapsing cliff, allowing no obstacle that it hits to remain standing, "falls with a crash, and suddenly everything seems to collapse," as our Virgil says.[36]

(23.1) That will be the explanation of earthquakes that shake from below. I move on to the second sort. The texture of the earth is loose, with a lot of spaces. Breath travels through these gaps, and when it enters in greater quantity and is not released, it shakes the earth. (2) Other people too agree with this explanation, as I said a short while ago.[37] If a mass of witnesses is going to make any impression on you, this view is also accepted by Callisthenes,[38] a far from insignificant man; for he had a noble intellect, one that would not tolerate an insane king. This is an undying accusation against Alexander, for which no courage, no success in war will atone: whenever someone says, "He killed many thousands of Persians," there will be a protest about Callisthenes; whenever it is said, "He killed Darius, who at that time ruled a mighty kingdom," there will be a protest about Callisthenes; whenever it is said, "He conquered everything as far as the ocean, and made an attempt on that too with fleets not seen before, and extended his empire from a corner of Thrace to the boundaries of the east," someone will say, "But he killed Callisthenes." He may have surpassed every precedent set by generals and kings, but of his achievements, none will be as great as a crime. (4) This Callisthenes,

in the books where he describes the inundation of Helice and Buris,[39] and the event that drove them into the sea, or the sea onto them, says what has already been said in an earlier section:[40] "Breath enters the earth through invisible openings; this happens everywhere, including under the sea. Then, when the pathway through which it had been descending is blocked, and the pressure of the water behind prevents its return, it oscillates backward and forward, and as it collides with itself, it weakens the earth. That is why places next to the sea are ravaged most often, and for that reason the power to cause earthquakes has been assigned to Neptune. Anyone who has learned to read knows that in Homer he is called *Enosichthon*."[41]

(24.1) I too agree that breath is the cause of this disastrous phenomenon. What I shall dispute is the way in which the breath enters: whether it is through fine passageways that are not visible to the eye, or through larger, broader ones, and whether it comes from deep below, or also through the earth's surface. (2) The latter is incredible. For in our bodies too the skin repels breath, and it has no way in except where it is inhaled. And once it is taken in, it cannot settle except in a more loose-knit part of the body; for it is retained not in the sinews or flesh, but among the vital organs, in a broad cavity inside us. (3) One may perhaps suspect the same about the earth, simply because earthquakes occur not on the earth's surface or near the surface, but beneath, and far below. There is evidence of this in the fact that extremely deep seas are disturbed, evidently because there is a quake in the earth above which they extend. So it is likely that the earth quakes deep below, and breath is gathered in huge caverns down there. (4) "That is not right," someone says. "When we shudder with cold, shivering results, and in just the same way the earth too is shaken by breath assailing it from outside." That is quite impossible. For the earth needs to be cold to undergo the same as we do when an external cause makes us shudder. I would grant that the earth does undergo something similar to our own experience, but not from a similar cause. (5) An internal, deeper injury must afflict the earth, and perhaps the most significant evidence for this is that, when in a violent earthquake there is vast subsidence, and the ground opens up, sometimes entire cities are swallowed and buried in the chasm. (6) Thucydides says that around the time of the Peloponnesian war all, or at least most, of the island of Atalante sank.[42] Take Posidonius's

word for it that the same happened at Sidon.[43] But there is no need for witnesses on this point: for we can remember that when the earth was torn apart by an internal quake, whole areas were broken up, and fields disappeared. I shall now say how I think this occurs.

(25.1) When with great force breath has completely filled an empty space in the earth and has started to struggle and to think of escape, it repeatedly strikes the sides of the space where it is lurking; and sometimes cities are situated above them. The sides are sometimes shaken so much that buildings overhead collapse, sometimes so much that the walls supporting the entire roof of the cavern fall down into the empty space below, and entire cities sink to a great depth. (2) Should you be inclined to believe it, they say that once Ossa was attached to Olympus; then it was separated by an earthquake, and the huge mass of the single mountain was split into two. The Peneus then flowed out, drying up the marshes with which Thessaly was afflicted, as it drew into itself the waters that had collected in the absence of an exit. The river Ladon is midway between Elis and Megalopolis, and an earthquake caused it to flow. (3) What do I want to prove with all this? That breath gathers in roomy caves (what else should I call empty spaces beneath the earth?). If this were not so, large tracts of the earth would be shaken, and many places would tremble simultaneously; but as it is, tiny portions of the earth suffer, and the quake never extends as much as two hundred miles. Just consider: this recent one that has filled the earth with stories did not spread beyond Campania. (4) Do I need to say that when Chalcis shook, Thebes stood still? that when Aegium suffered, Patrae, so close to it, merely heard about the earthquake? That great convulsion in which two cities disappeared, Helice and Buris, stopped short of Aegium. So it is clear that the earthquake spreads as far as the hollowness of the empty space extends beneath the earth.

(26.1) To prove this, I could have exploited the authority of distinguished men who record that Egypt has never experienced tremors. The explanation they give for this is that the whole country has been formed from mud. For if Homer can be trusted,[44] Pharos used to be as far from the mainland as a ship can travel in a day under full sail. But the island has been brought close to the mainland: for the Nile, with its muddy current, carrying lots of silt with it and continually depositing it on the existing land, has constantly been

enlarging Egypt with an annual supplement. So the land is made of rich, muddy soil and has no gaps in it. It has solidified with the drying out of the mud, whose composition was densely packed and settled, since its parts were glued together, and no empty space could appear between them, since liquid, soft matter constantly accumulated on top of the solid.

(2) However, Egypt does have earthquakes, and so does Delos, which Virgil commanded to stand still: "and he granted it to be inhabited without being shaken, and to despise the winds."[45] Philosophers too, a credulous race, have said that it does not have earthquakes, on the authority of Pindar.[46] Thucydides says that earlier it was unaffected,[47] but it was shaken around the time of the Peloponnesian war. (3) Callisthenes says that this occurred on another occasion too:[48] "Among the many prodigies," he says, "that heralded the destruction of the two cities, Helice and Buris, the most notable were an immense fiery column and an earthquake on Delos." He thinks it is regarded as immovable because it is in the middle of the sea and has hollow cliffs and permeable rocks such as allow trapped air to get out again; for this reason, islands generally have firmer soil, and cities are safer the nearer they are to the sea. (4) Pompeii and Herculaneum have discovered that this is untrue. Add that every sea shore is prone to earthquakes: thus Paphos has been destroyed more than once, and Nicopolis, which is unstable and now familiar with this catastrophe; Cyprus is surrounded by deep sea and yet has earthquakes; and Tyre itself both has earthquakes and is lapped by the sea.

Such are the explanations given for the earth's trembling. **(27.1)** But some particular events are reported to have occurred in this Campanian earthquake, and they require explanation. They say that a flock of hundreds of sheep was killed in the Pompeii area. (2) There is no reason for you to think this happened to those sheep because of fear: we have said that a plague commonly occurs after major earthquakes,[49] and this is not surprising. For many causes of death are lurking deep below: the air itself can be unhealthy for those who breathe it, either through a defect in the earth, or because the air is stagnating inertly in perpetual darkness, or because of contamination by the corrupting effects of subterranean fires. When it emerges from its long decay, it infects and pollutes our pure, clear atmosphere, and when people inhale this unfamiliar breath, it causes new kinds of

disease. (3) What about the presence deep below of water too that is unusable and plague-ridden, since it is never disturbed by use, never stirred up by a fresh breeze? So this murky water, covered in dense, perpetual darkness, contains solely what is intrinsically deadly and inimical to our bodies. Also, the air that is mixed with that water and settles among those marshes, when it emerges, broadcasts its infection far and wide, and kills those who breathe it. (4) Plague often attacks animals first, and they feel the effects more easily the greedier they are: they especially enjoy the open air and the water supplies that are particularly responsible for plagues. Sheep have a weaker constitution, and they carry their heads closer to the ground, so I am not surprised that they were struck down, since they inhaled the currents of poisonous air near ground level. This would have harmed humans too if it had emerged in greater quantity; but the plentiful supply of pure air overwhelmed it before it could rise high enough to be breathed by humans.

(28.1) You may infer that the earth contains many deadly substances just from the fact that so many poisons grow in it, not because sown by human hand, but spontaneously. This must be because the soil contains harmful seeds as well as beneficial ones. And consider this: in several places in Italy an unhealthy vapor, safe for neither humans nor wild animals to inhale, is given off through certain passageways. Birds too, if they fly into it before it has been tempered by the more wholesome atmosphere, drop dead in mid flight; their bodies are discolored, and their necks swollen, just as if they had been strangled. (2) This breath, so long as it remains in the earth, flows through a narrow aperture and has only enough power to kill things that look down into it and enter it of their own accord; but when it has been hidden for centuries and has grown in virulence in the darkness and the grim conditions, it becomes more concentrated with the passage of time and more dangerous the more sluggish it is. When it finds an exit, it pours out that everlasting poison formed in the gloomy cold, that hellish contagion, and it darkens the air in our world. For the better is overcome by the worse. (3) Then even the purer breath becomes infectious; then there is one sudden death after another, and there are hideous forms of disease, for they spring from new causes. The disaster is short-lived or long-lasting according to the strength of the infection, and the plague does not end until

the spaciousness of the atmosphere and the action of the winds has dispersed that oppressive breath.

(29.1) A number of people ran off as though mad or stupefied: this was the result of fear, which causes mental disturbance when it is private and moderate; so what happens when there is terror on a public scale? When cities are collapsing, peoples are being destroyed, and the earth is quaking, is it surprising that minds deprived of support in the midst of grief and fear became deranged? (2) It is not easy to stay sane in the midst of great disasters. So the weakest temperaments generally reach such a pitch of terror that they lose their heads. No one can panic without some loss of sanity, and anyone who is afraid resembles a madman. But fear soon restores some people to their normal selves, while it disturbs others more deeply and drives them mad. (3) That is why in time of war people wander around distraught, and nowhere will you find more cases of people prophesying than when panic blended with religion has attacked their minds.

(30.1) I am not surprised that a statue was split apart, for I have said that mountains have separated from mountains, and the ground itself has been torn apart from the depths:

> They say that once these regions, convulsed by violence and
> wide devastation,
> (long aeons of time can cause so much change)
> sprang apart, although to begin with both the lands
> were one. The ocean came with mighty force and split
> the huge flank of Hesperia[50] from the flank of Sicily, and ran in
> a narrow strait
> between fields and cities that were separated by the sea.[51]

(2) You can see whole regions torn up from their foundations and what had been next door lying across the sea; you can see cities and nations rent apart when one section of nature is stirred up and violently displaces sea, fire, or breath. The power is amazing since it comes from the whole universe: even if it rages only in part, it rages with the power of the world. (3) Thus the sea also severed the Spanish provinces from their union with Africa;[52] thus Sicily was wrenched away from Italy in that inundation celebrated by the greatest poets.

Forces that come from deep down have considerably more power, for struggling through constrictions makes things more violent.

(4) Enough has been said about the powerful effects and the amazing sights produced by these earthquakes. So why is anyone astonished that the bronze of a single statue, which is not even solid, but hollow and thin, was split apart? Perhaps breath that was looking for a way out became shut up in it? Also, as everybody knows, we have seen buildings whose corners had been pulled apart get shaken and put back together again. Some buildings that had rather inadequate foundations, and had been put up in a rather careless and slapdash way by the builders, have had their structure strengthened by repeated shaking in the earthquake! (5) Now if it cracks whole walls and whole houses and fractures the sides of great towers, however solid they are, and shatters supporting piers, why should anyone think it worthy of notice that a statue was evenly cut into two sections from head to foot?

(31.1) Why did the earthquake last several days? Campania did not stop experiencing constant tremors, which were gentler, but still very destructive, because they were shaking things that had already been shaken, things that were standing precariously and did not need a push, but only a vibration, to make them fall. Clearly not all the breath had yet escaped, and though most had emerged, some was still milling around. Among the arguments proving that the cause of earthquakes is breath, you should not hesitate to include this as well: (2) when there has been a very powerful earthquake in which cities and regions have been savaged, there cannot immediately be another one equal to it; instead, after the very powerful one there are weak tremors, because the more violent force has already created an exit for the struggling winds. The residue of the remaining breath is not as powerful, and does not need to fight, since it has already found a route and is following where the first, most powerful force escaped.

(3) I think the following also deserves to be recorded, something experienced by a very learned and very distinguished man, who happened to be in the bath when it occurred: he declares that he saw the pieces of mosaic covering the floor in the bathroom move apart from each other and come together again, and the water one moment being drawn into the cracks as the paving parted, the next being forced

out, bubbling, as it was pushed together again. I also heard him saying that he saw walls shaking more flexibly and more frequently than the nature of solid things permits.

(32.1) So much for explanations, Lucilius, excellent man: now for what serves to reassure our minds, since it is more important to us that they become more courageous than that they become better educated. But you cannot have the one without the other. The mind gains strength solely from liberal studies and from the contemplation of nature. (2) For whom will this disaster not make more resolute, more defiant, against all others? Why should I tremble at a human being or a wild beast, or at an arrow or a spear? Greater dangers are waiting for me: we are the targets of lightning-bolts, of the earth, and of large segments of nature. (3) So we must challenge death with great courage, whether it attacks us with a cruel, large-scale assault, or with an ordinary, everyday exit. It does not matter how menacingly it comes and how great the forces it deploys against us—what it is asking of us is insignificant. Old age will take it from us, so will a simple earache, so will the spread of an infection in our body, so will food that disagrees with our stomach, so will a slight injury to the foot.

(4) A person's soul is a trivial thing, but contempt for one's soul is a tremendous thing. Anyone who treats it with contempt will watch the seas in turmoil without anxiety, even if all the winds have whipped them up, even if through some disturbance to the world the tide is diverting the entire ocean onto the land. He will look without anxiety at the cruel, dreadful sight of the sky flashing with lightning, even if the sky is fractured and is concocting fires that will destroy everything, starting with itself.[53] He will look without anxiety at the ground gaping open as its structure shatters, even if the kingdoms of the underworld were to be revealed. He will stand above that abyss unflinching and perhaps will leap in where he will have to fall. (5) What is it to me how great are the causes of my death? Death itself is not a great thing. So if we wish to be happy, not to be racked by fear of humans, or gods, or circumstances; to despise fortune, whose promises are unnecessary and whose threats are insubstantial; if we wish to have a tranquil existence and to compete with the gods themselves in happiness, then we must keep our soul ready. Whether plots or diseases attack it, whether the swords of enemies or of citizens, whether the crash of falling blocks of flats, whether the collapse

of the earth itself, or a huge, powerful fire that embraces cities and farmland in the same devastation, whatever disaster wishes to receive our soul, let it do so. (6) What else do I need to do but encourage my soul on its way out and send it off with good omens? "Go bravely, go with good fortune! Do not hesitate: you are being given back. There is no question about the fact, only about the timing; you are doing what must be done sooner or later. Do not ask anything, do not be afraid, do not turn back as though you are going to face something evil. Nature, which gave birth to you, is waiting for you; so is a better, safer, place. (7) There the earth does not tremble, nor do winds collide with each other with loud crashing of clouds; fires do not devastate regions and cities. There is no fear of shipwrecks that swallow up whole fleets, no weapons arrayed beneath the standards on opposing sides, when the same madness afflicts many thousands bent on mutual destruction, no plague with communal funeral pyres burning anonymously for dying nations. Suppose death is trivial: why are we afraid? Suppose it is serious: rather let it happen once and for all than constantly hang over us. (8) Should I be afraid of dying, when the earth dies before I do, when what shakes is shaken, when it harms itself in the process of harming us? The sea claimed Helice and Buris in their entirety: should I fear for one insignificant body? People sail above the two towns, that is two that we know about, that records preserved in literature have brought to our knowledge: how many more towns have been submerged in other places, how many nations has either the land or the sea trapped beneath it! Should I protest at my own ending, when I know that my existence is not endless? Or indeed, when I know that everything has an end, should I be afraid of my final gasp?"

(9) So, Lucilius, as far as you are able, exhort yourself against the fear of death. This fear is what demeans us; this is what disturbs and ruins the very life it spares; this exaggerates it all, the earthquakes and the lightning-bolts. You will face all that without flinching if you consider that there is no difference between a short time and a long one. (10) What we lose are only hours. Suppose they are days, suppose they are months, suppose they are years: we lose them, but they are going to be lost anyway. What difference does it make, I ask you, whether I live that long? Time flows on and abandons those who are greediest for it. Neither what will be nor what has been is in

my possession. I am suspended on a point of fleeting time; and yet it takes a great man to be moderate in his demand for time! (11) The wise Laelius,[54] when someone said, "I've got sixty years to my credit," replied rather neatly, "You're talking about sixty years you haven't got!" Even when we see that we are counting the years we have lost, can we still not understand that our life is essentially something we cannot cling on to, that the time allocated to us is never in our possession? (12) Let us imprint this on our minds, let us constantly say this to ourselves: "We must die." When? What does that matter to you? How? What does that matter to you? Death is a law of nature; death is the tribute and duty of mortals, and the remedy for every suffering. Anyone who is afraid is longing for it. Forget everything else, Lucilius, and concentrate on this one thing, on not being afraid of the word "death." By constant reflection make death a friend of yours, so that, if it allows, you can go out to meet it.

On Comets

(1.1) No one is so slow and dull-witted and bowed down toward the ground that he does not stand up straight and rise up with his whole mind toward the divine, especially when some new marvel has shone from the sky. As long as things follow their usual courses, familiarity detracts from the greatness of the events; for we are so constituted that everyday things, even if they deserve admiration, pass us by, and, conversely, the sight of even the least important things gives pleasure if their appearance is unusual. (2) So the host of stars that enhance the beauty of this immense body[1] does not draw a crowd; but when something is different from normal, everyone's gaze is fixed on the sky. The sun has no spectators unless it is being eclipsed; no one observes the moon unless it is struggling. Then cities shout out, then, through futile superstition, everyone makes a din to protect himself.[2] (3) But how much more significant it is that the sun has as many steps, so to speak, as it has days,[3] and that it defines the year by its orbit; that after the summer solstice it turns so as to make the days shorter; that after the equinox it at once sinks and makes the nights longer;[4] that it hides the stars; that, though it is so much larger than the earth, it does not burn it, but warms it, controlling its heat with periods of greater and lesser intensity; that it never makes the moon full except when it is on the opposite side, nor makes it dark <except when it is adjacent>. (4) But we take no notice of all this as long as regularity is maintained. If anything is disturbed, or something unaccustomed shines forth, we look, we question, we point. So natural is it to be amazed at novelty rather than greatness.

(5) The same happens with comets: if a fiery body appears that is rare and of unusual shape, everyone longs to know what it is; forgetting the other bodies, they ask about the newcomer, not knowing whether they ought to feel wonder or fear. For there is no shortage of people who inspire terror, who base grim predictions on it. So people are full of questions and want to discover whether it is a prodigy or a star. (6) But, by Hercules, one could not inquire about anything more magnificent or learn about anything more profitable than the

nature of the stars and planets, whether they are a compact flame (as is confirmed by our eyesight and by the light flowing and the heat descending from them), or they are not spheres of flame, but solid, earthy bodies, which do not shine of their own accord but draw brightness and heat from the fiery regions through which they fly. (7) Some distinguished men were of that opinion, believing that the stars are constructed from solid matter and feed on external fire. "For flame," they say, "would naturally disperse unless it had something to hold on to and be held by. A concentration of flame that was not attached to a durable body would certainly by now have disintegrated in the whirling motion of the world."

(2.1) To pursue this investigation, it will be useful to ask whether comets have the same status as the heavenly bodies just mentioned. They seem to share some common features with them, namely, risings and settings, and also their appearance, even though it is dispersed and elongated; for they are just as fiery and bright. (2) So if all the stars are made of earth, comets will have the same nature. But if these are nothing but pure fire, and they last for six months without being broken up by the rotation and the speed of the world, then the stars too could consist of very fine matter and still not be dispersed by the constant turning of the heavens. (3) Another reason for examining comets is so that we may know whether the world goes round as the earth stands still, or the earth revolves as the world stands still. There have been people who said that we are the ones whom nature keeps on the move, though we do not know it, and that risings and settings are not produced by the motion of the heavens, <but> we ourselves rise and set. This issue deserves consideration, so that we may know our own situation, whether we occupy a very inactive or a very fast-moving position, whether god makes everything move round us, or makes us move.

(3.1) It is essential to have records of past appearances of comets. Their paths cannot yet be understood because of their infrequency, nor can it be established whether they follow a cycle and appear in accordance with an established pattern when their day arrives. This branch of astronomical observation is new and was introduced to Greece recently. (2) Democritus too,[5] the most acute of all the ancients, said he suspected that there are more moving stars, but he did not give either their number or their names, for the motions

of the five stars were not yet understood.[6] Eudoxus first introduced knowledge of their orbits to Greece from Egypt,[7] but he says nothing about comets. From this it is clear that not even the Egyptians, who had a very serious interest in the heavens, had developed this area of astronomy. (3) Later on, Conon,[8] another careful researcher, catalogued the solar eclipses observed by the Egyptians; but he did not mention comets, and if he had come across any discoveries in their writings, he would not have omitted to say so.

(4.1) Two people say that they studied with the Chaldaeans: Epigenes, and Apollonius of Myndus, a great expert on investigating horoscopes;[9] but they disagree with each other. The latter says that comets are included among the planets by the Chaldaeans, and their courses are understood. Epigenes, on the other hand, says that the Chaldaeans have made no discoveries about comets, but it seems that they are set alight by a sort of whirlwind of fast-moving, twisting air. So first, if you agree, let us describe his views and refute them.

(2) He thinks that the planet Saturn has a major influence over all the motions of things in the atmosphere:[10] "When it bears down on the constellations closest to Mars, or crosses into the neighborhood of the moon, or intercepts the sun's rays, since it is windy and cold by nature, it makes the air contract and mass together at many points; then if it absorbs the sun's rays, there is thunder and lightning; if Mars is in conjunction as well, there are lightning-bolts. (3) Besides," he says, "lightning-bolts and lightning-flashes are made of different material: for evaporation from water and any kind of moisture produce only flashes in the sky, which threaten without striking; but the hotter, drier exhalation from the earth hammers out lightning-bolts. Beams and torches,[11] which differ from each other only in the size of their fire, are formed as follows: (4) when a ball of air has enclosed moist and earthy products in itself, what we call a whirlwind, then wherever it travels, it presents the appearance of an elongated fire; it lasts for as long as that accumulation of air, which carries a lot of moist and earthy material along inside it."

(5.1) To start with the last of his falsehoods, it is not true that beams and torches are generated by a whirlwind. For a whirlwind is formed and moves along near to the earth; so it tears trees up by the roots, and wherever it attacks, it strips the ground bare, sometimes grabbing hold of forests and buildings. It is usually below the clouds,

and certainly never above them. On the other hand a higher region of the sky displays beams, and so they never interrupt our view of the clouds. (2) Besides, a whirlwind rushes along more swiftly than any cloud and has a circular rotation; in addition it comes to an end quickly, and destroys itself with its own force. Beams, however, do not race across or fly past like torches, but stand still and shine in the same region of the sky. (3) Certainly Charmander,[12] in the book he wrote about comets, says that Anaxagoras saw a massive and unusual light in the sky,[13] the size of a large beam, and it shone for many days. Callisthenes records that a similar shape, resembling an elongated fire,[14] shone before the sea overwhelmed Bura and Helice.[15] (4) Aristotle says this was not a beam but a comet,[16] but because of the intense heat, the dispersed fire was not visible; yet as time went on, once it was blazing less fiercely, the standard comet shape was restored. In this fiery object there were many features deserving attention, none more so than the fact that, as soon as it shone in the sky, the sea covered Bura and Helice. (5) Could it be that Aristotle believed that not only this beam but all beams are comets, the difference being that beams have unbroken fire, whereas comets have dispersed fire? For beams have a steady flame that is not interrupted or feeble at any point, and is dense at its extremities, as Callisthenes records in the case I have just mentioned.

(6.1) "There are two kinds of comet," says Epigenes. "Some spread their brightness in all directions and do not change position; others extend their scattered fire in one direction, like hair, and move in relation to the fixed stars" (two of this sort have appeared in our own day).[17] "The first kind, which have hair on every side and are motionless, are usually low down and are ignited by the same causes as beams and torches, from disorderly, turbulent air that whirls round with it many dry and moist particles that have been exhaled from the earth. (2) For breath that is forced out through confined spaces can ignite air above it that is full of suitable fuel for fire, then can propel it upward from the lower levels, until for some reason it flows back down again and becomes less intense. It can rise again the next day and subsequent days, and can set the same region ablaze. For we see winds come again on cue several days running; showers, also, and other sorts of weather, return at the designated time." (3) To express his meaning briefly, he thinks these comets are produced in the same

way as the fires emitted by a whirlwind: there is just this difference, that these fires are driven from above down to earth by the whirlwind, while comets fight their way upward from earth.

(7.1) There are many objections to this view. First, if wind were responsible, a comet would never appear without a wind: but as a matter of fact, they appear even in the calmest air. Then if they were produced by wind, they would cease along with the wind; and if they started with wind, they would increase with the wind, and the fiercer it was, the brighter they would burn. There is this further point, that wind propels many sections of the atmosphere, but a comet appears in just one place; and wind does not reach the highest levels, but comets are seen higher than winds can go.

(2) He then moves on to the comets that he says are more definitely like stars, because they move forward and pass the constellations. He says that they are produced by the same causes as those he called the lower comets; the only difference is that exhalations from the earth carrying a lot of dry particles with them head for a higher region and are pushed up by the north wind into the loftier reaches of the heavens. (3) <But> if it were the north wind that pushed them, they would always be driven southward, in the direction that this wind blows: but they move in different directions, some east, some west, all of them in a curve, and a wind would not produce such a path. Then if the force of the north wind lifted them from the earth up high, comets would not appear along with other winds; yet they do.

(8.1) Now let us rebut his other explanation (for he gives both): "When any moist and dry matter that the earth has exhaled comes together, the discord between these bodies turns the breath into a whirlwind. Then anything enclosed within that powerful, revolving wind is set on fire by its motion and lifted up high. The brightness of the fire that is emitted lasts for as long as its fuel holds out; when this comes to an end, the brightness dies down." (2) Anyone who says this fails to notice what the motion of whirlwinds and the motion of comets are like: the first is swift, violent, and more rapid than winds themselves; the motion of comets is gradual, and the distance covered in a day and a night is imperceptible. Then the motion of whirlwinds is erratic, disjointed, and, to use Sallust's word,[18] eddying, whereas that of comets is regular, pressing on along a preordained course. (3) Would any of us believe that the moon or the five stars are swept

along by a wind or spun round by a whirlwind? I think not. Why? Because their motion is not irregular and uncontrolled. Let us apply the same argument to comets: they do not move in a confused or disorderly manner, allowing someone to believe that they are impelled by unruly, erratic causes. (4) Then even if those eddies could capture earthy, moist particles and force them from down below to up above, they still would not carry them higher than the moon. Their force runs only as far as the clouds, but we see comets mingling with the stars and gliding through the upper regions. Therefore it is not likely that a whirlwind persists over such a great distance, for the larger it is, the sooner it disintegrates. **(9.1)** So let him choose: either a slight force will not be capable of reaching that high, or a great, vigorous force will destroy itself first.

In addition, the reason why those lower comets do not go higher, he thinks, is that they contain more earthy matter: their weight keeps them close to earth. Yet there must be more abundant material in the more enduring, higher comets; for they would not appear for a longer time if they were not sustained by a greater supply of nourishment.

(2) I was just saying that an eddying motion cannot last long or rise higher than the moon or as far as the stellar region. Without doubt a whirlwind is produced by several winds in competition with each other. This competition cannot last for long; for after the breath has revolved erratically and uncertainly, eventually all the winds surrender their power to one wind. (3) A violent storm is never long-lasting: the greater the strength of gales, the shorter their duration; when winds reach their maximum, they abate; any violent force is inevitably driven toward its own extinction by its very intensity. So nobody has watched a whirlwind for a whole day, not even for an hour. Its speed is remarkable, and its brevity is remarkable. Also, it revolves more violently and more swiftly at the earth's surface and near it. The higher it is, the less cohesive and the more volatile it is, and so it disperses. (4) Add that, even if it did reach the highest level, where the stars have their courses, it would certainly be broken up by the motion that turns the universe. For what is swifter than the rotation of the world? It would scatter the combined power of all the winds together, and the solid, sturdy structure of the earth, never mind a little bit of whirling air.

(10.1) And another point: a fire that has been carried by a whirlwind cannot remain high up unless the whirlwind itself also remains. Now what is as incredible as a whirlwind lasting a long time, especially when its movement is overcome by a contrary movement? For that region has its own whirling motion, which sweeps the heavens along, "and carries the lofty stars and whirls them with swift revolution."[19] And even supposing you granted them some adjournment—which is quite out of the question—what can be said about these comets that have been visible for six months? (2) Then there would have to be two movements in the same place, one of them that divine, constant movement doing its job without interruption; the other a new, recent one brought by the whirlwind. Inevitably one will interfere with the other. Yet the orbiting of the moon and the motion of the other stars above the moon are unalterable: they never hesitate or pause or give us any reason to suspect that they have encountered a delay. So it is incredible that a whirlwind, the most violent and disruptive kind of storm, should reach right into the ranks of the stars and rotate amid those ordered, tranquil bodies. (3) Let us suppose that fire is ignited by the spinning of a whirlwind, is driven from our level up to the heavens, and presents the impression and the appearance of an elongated star: a fire, I think, must resemble the thing that produces it. Now the shape of a whirlwind is round (for it turns on the same spot and revolves like a spinning pillar): so the fire confined within it must also resemble it. But a comet is elongated and dispersed, and not at all like something with a circular form.

(11.1) Let us leave Epigenes and deal with the views of other people. Before I begin to expound them, it must first be acknowledged that comets are not seen just in one part of the sky, nor just in the zodiac, but in both east and west alike, though most frequently in the north. (2) They do not have the same shape, <but they are essentially the same kind of thing.> The Greeks have distinguished between those that have flame hanging down like a beard, those that, as it were, scatter their hair in all directions round them, and those that have fire spreading out but tapering to a point; and yet all these are the same kind of thing and are correctly called comets. (3) Since their forms appear at long intervals, it is difficult to compare them with each other. Even at the time of their appearance, observers do not agree about their characteristics, but, according as each person

has sharper or weaker eyesight, so he says it is either brighter or redder, and the hairs are either drawn inward or spread out sideways.[20] But whether there are different kinds or not, comets must all be produced in the same way. One thing must be agreed, that, contrary to normal, a strange kind of star is seen trailing a fire that spreads out around it.

(12.1) Some of the ancients adopt the following explanation. When one of the planets comes into conjunction with another, the light of the two is merged into one, and the appearance of an elongated star is created. This occurs not only when one planet touches another, but even when it comes close, for the gap between the two is illuminated by them both and set alight, and produces an elongated fire. (2) Our response to this will be that there is a fixed number of moving stars, and regularly both they and a comet appear simultaneously, from which it is clear that the comet is not produced by their conjunction but is distinct and independent. (3) Also, one star frequently moves below the path of a higher star: Saturn is sometimes above Jupiter, and Mars looks down vertically on Venus or Mercury, but a comet is not created by their conjunction, when one passes below the other. Otherwise they would be produced every year, for every year some stars are together in the same sign of the zodiac. (4) If a comet were created by one star moving above another, it would cease to exist in a moment. For the stars pass at high speed, and so all eclipses are short-lived, because the same motion that brought them together swiftly separates them. We see the sun and moon set free within a brief interval after their eclipse has begun: how much swifter the separation must be in the case of much smaller stars. Yet comets last for six months, which would not happen if they were generated by the convergence of two stars. They cannot remain together for long: the laws controlling their velocity must separate them.

(5) Besides, they seem to us to be close together, but they are separated by huge distances. So how can one star transmit fire to another star so that they appear to be joined, when they are separated by a huge space? (6) "The light of two stars is blended," someone replies, "and presents the appearance of a single star; in just the same way a cloud turns red when sunlight strikes it, in just the same way things are golden-colored at dawn or dusk, in just the same way a rainbow or second sun becomes visible." (7) In the first place, all these phe-

nomena are produced by a powerful force, for it is the sun that sets them alight; stars do not have the same effect. Next, all of these phenomena are only generated below the moon and close to the earth; the higher regions are pure, unsullied, and constantly maintain their own color. (8) Also, if something like that did occur, it would not last but would soon be extinguished, just as the garlands that circle the sun or moon disappear within a very short time. Not even a rainbow continues for long. If there were something capable of blurring the gap between two stars, it would dissolve just as quickly; certainly it would not last for as long as comets usually remain. The stars move within the zodiac, they keep to this track; but comets are seen everywhere. They no more have a fixed time when they must appear than a fixed space they must not move out of.

(13.1) Against this objection Artemidorus says the following:[21] it is not that only these five stars move erratically, but only these ones have been observed; however, countless others circle unseen, unknown to us either because of the dimness of their light, or because the orientation of their orbits means that they are visible only when they reach the extremities of the orbits. "So," he says, "some stars appear that are new to us; they blend their light with the regular stars and stretch out a larger fire than stars usually do." (2) This is the least important of the lies he tells. His whole account of the world is a shameless lie. If we believe him, the outer edge of the heavens is completely solid, "hard, like a roof, with a thick, dense body formed by atoms assembled and amassed together. (3) Next to it is a fiery layer, so densely compacted that it cannot be broken up or damaged; it has some breathing-holes and windows, as it were, through which fires pour in from outside the world, not big enough to disturb the interior, <***>[22] again they flow from the world to the outside. So these things that appear unexpectedly have poured in from the matter located outside the world."

(14.1) Rebutting these ideas is just like sticking out your arm and punching at the wind. I should like this fellow who has constructed such a solid ceiling over the world to tell me why we should take his word for it that the thickness of the heavens is so great. What was it that could transport such solid bodies up there and keep them there? (2) Next, anything that is as thick as that is necessarily very heavy as well: so how do heavy objects remain at the highest level? Why

does that structure not fall down and break under its own burden? It is impossible for such an enormous weight as he suggests to remain suspended and be supported by something light. (3) Nor can it be said that there are some cables outside to prevent it from falling, nor, again, that in the middle there is some support in place to take the weight of its looming body and prop it up. Again, no one will dare to say that the world is moving through infinite space and is actually falling without it being apparent whether it is falling, because its headlong descent is eternal, since it has nothing at the bottom to collide with. (4) Some people have said this about the earth, since they could find no explanation for its mass being stationary in the air. "It is moving constantly," they say, "but it is not apparent whether it is falling, because it is falling into infinite space."

Next, how will you prove that there are not just five planets, but many of them, and in many regions of the world? Or if one may vouch for this without any credible evidence, why should someone not say either that all the stars move like planets, or that none does? Besides, that host of stars wandering all over the place is no help to you: for the more there are, the more often they will encounter others; but comets are rare, which is what makes them remarkable.

(15.1) What do you say to the fact that every age that has observed the appearance of such stars and recorded them for posterity will testify against you? After the death of Demetrius, king of Syria, whose children were Demetrius and Antiochus, shortly before the Achaean war,[23] a comet shone brightly, no smaller than the sun. At first it was a fiery, reddish circle, emitting bright light sufficient to overcome the darkness; then gradually its size contracted, and its brightness faded, and finally it disappeared totally. So how many stars must converge to produce such a large body? Even if you gather a thousand together in one place, they will never match the appearance of the sun. (2) In the reign of Attalus,[24] to begin with, a comet of modest size appeared; later it rose higher, spread out, and reached as far as the equinoctial circle, extending to enormous length, as big as the stretch of the heavens called the Milky Way. How many planets need to congregate in order to fill such a long section of the heavens with continuous fire?

(16.1) We have spoken against the arguments; we need to speak against the witnesses. It does not require great effort to destroy the

authority of Ephorus:[25] he is a historian. Some of them court popularity with tales of the unbelievable and use marvelous stories to engage the reader who will turn to something else if presented with a series of everyday events. Some of them are gullible, some are negligent. Falsehood takes some by surprise, and is welcomed by others; the former do not avoid it, the latter seek it out. (2) This applies generally to the whole tribe of historians, who do not think their work can win approval and become popular without a sprinkling of falsehood. Ephorus is not someone of the most scrupulous reliability: he is often deceived, more often he deceives, as in the case of this comet, which was watched by the eyes of all humankind, because it brought about the occurrence of a major event, drowning Helice and Bura at its appearance. He says it separated into two stars; but apart from him no one has reported this. (3) Who could have observed that moment at which the comet broke up and was reduced to two pieces? How come, if there is somebody who has seen a comet being split in two, that nobody has seen one forming from two stars? Why did he not add what stars it divided into, since it must have been some of the five stars?

(17.1) Apollonius of Myndus takes a different view:[26] he says not that one comet is produced from many planets, but that many comets are planets. "It is not a deceptive illusion," he says, "nor fire spreading out when two stars are close, but a comet is an individual heavenly body just like the sun and moon. Its shape is as we see it, not confined in a circle, but more extended, stretching out lengthwise. (2) But its course is not discernible: it cuts through the higher levels of the world and only becomes visible when it reaches the lowest point of its course. We should not think that the same comet was seen in Claudius's reign as we saw in Augustus's, nor that the one that appeared in Nero Caesar's reign and did away with the ill repute of comets was similar to the one that emerged after the departure of the deified Julius at the games of Venus Genetrix at around 5 P.M.[27] (3) There are many comets of various sorts, unequal in size, dissimilar in color: some are red without any brightness; others are brilliant, with pure, clear light; others are like flame, not pure or fine, but with a lot of smoky heat billowing out around them; some are blood-red and menacing, because they present an omen of bloodshed to come. Comets reduce and increase their brightness just like other stars that

are brighter and larger when they have descended, because they are seen at closer quarters, but are smaller when they reverse direction, and dimmer, because they are moving further away."[28]

(18.1) An immediate response to this is that what happens in the case of comets is different from what happens in the case of other heavenly bodies. For comets are at their greatest size on the day they first appear. They ought to get bigger the nearer they approach, but as things are, their initial appearance continues until they begin to disappear. Then the argument used against earlier people also applies to him: if the comet followed a wandering path and were a planet, it would move within the boundaries of the zodiac, within which all the planets confine their courses. (2) One star is never visible through another star; our eyesight cannot pass through the middle of a planet so as to see through it to what is above; but one can see through a comet, just as through a cloud, to what is beyond. This shows that it is not a planet but a faint, impromptu fire.

(19.1) Our own Zeno holds the following view:[29] he thinks that stars converge and amalgamate their rays; from this coalition of light the impression of an elongated star is created.

So some people think that comets do not really exist, but their appearance is produced by reflections from neighboring stars, or by the conjunction of stars that coalesce. (2) Others say that they do exist, but have their own orbits and emerge to human view after fixed intervals. Others say they do exist, but are not what you could call stars, because they fade away and do not last for long, disintegrating after a brief period of time.

(20.1) Most of our school hold this view and do not think that it conflicts with the truth. For we see various kinds of fire being formed up in the sky: sometimes the sky blazes, sometimes "long tracks of flames gleam in their wake,"[30] sometimes torches are swept along with a huge fire. Lightning-bolts themselves, though with their remarkable speed they instantaneously flash past our sight and leave it far behind, are fires produced by air undergoing friction and colliding against itself with enormous force. So they do not linger, but, once ejected, they fly along and soon disappear. (2) But other kinds of fire do last for a long time, and do not disperse until all the fuel on which they were feeding has been used up. To this category belong the remarkable phenomena that Posidonius writes about,[31] blaz-

ing columns, and shields, and other notable, strange kinds of flame, which would not attract attention if they followed regular courses and obeyed the law. Everyone is astonished at these phenomena that produce an unexpected fire from on high, whether something flashes out and disappears, or it stands still, like a marvel, when condensed air is concentrated and turns into fire. (3) And tell me: does a cavity not sometimes open up as the aether retreats backward, and a huge light appears in the depression? You might exclaim, "What is this? 'I see the heavens parting in the middle and stars wandering in the firmament'";[32] they sometimes shine without waiting for night time, and burst into view in the middle of the day. But there is a different sort of explanation for their appearing in the atmosphere at the wrong time, for it is agreed that they are there even when they are hidden. (4) We fail to see many comets because they are concealed by the sun's rays. Posidonius records that once when the sun was eclipsed a comet appeared,[33] which the nearby sun had hidden from view. Often when the sun has set, scattered fires appear not far from it; clearly the star itself is bathed in the sun's light and so cannot be seen, but its hair escapes the sun's rays.

(21.1) So our people agree that comets, like torches, like trumpets and beams and other celestial portents, are produced by dense air. Therefore they appear most commonly in the north, which has the greatest quantity of sluggish air. (2) So why does a comet not stand still but move forward? I shall explain: like fire, it follows its sustenance; although its natural tendency is upward, still, if its fuel gives out, it moves back and descends of its own accord. In the air too it does not push to right or left—in fact it has no path—but creeps along where a stretch of fodder leads it; it does not advance like a star but feeds like a fire. (3) So why does it appear for a long period and not get swiftly extinguished? The comet that we have seen in the most fortunate principate of Nero remained visible for six months, traveling round in the opposite direction to the Claudian comet. For the earlier one, rising from the north toward the zenith, made for the east, growing dimmer all the time; the recent one started in the same quarter, but, as it made for the west, it turned south, and disappeared from view there. (4) Evidently the earlier one found smokier material, more suitable for fire, <in that region,> and followed it; whereas the recent one found the other region richer and more plentiful,

and so it descended in that direction, attracted by the fuel, not the path. The path clearly differed in the case of the two comets we have watched, since the one moved to the right, the other to the left. But all the planets move in the same direction, that is, opposite to the movement of the world (which rotates from east to west, while the planets go from west to east). So they have a twofold motion: with one they go their own way, with the other they are carried along.

(22.1) I do not agree with our people: for I think of a comet not as a fire that appears from nowhere, but as one of the eternal products of nature. In the first place, everything created from air is short-lived, for it is generated in an evanescent, impermanent substance. How can anything stay the same for a long time in the air, when the air itself never stays the same for long? It is constantly flowing, and its periods of rest are brief. In a fleeting moment it changes to a different state from the one it was in, now rainy, now fine, now fluctuating between the two. Clouds are very closely related to the air, for it congeals into them and dissolves out of them: they gather together at one moment, move apart at the next, and never stay still. It is impossible for a steady fire to reside in a changeable body and to remain there as persistently as the things that nature has arranged should never be driven off course. (2) Then, if the fire stuck with its fuel, it would always descend, for air is thicker the closer it is to earth. But comets never sink right down or get close to the ground.

(23.1) Again, fire goes either where its nature takes it, that is upward, or where it is dragged by the material it has clung to and feeds on. None of the regular, celestial fires has a winding course: it is characteristic of a star to describe a circle. Whether other comets have done this I do not know: but two in our lifetime have. (2) Next, everything set alight by a temporary cause quickly dies down: so torches blaze while they pass by; so lightning-bolts are powerful enough for only one strike; so what are called shooting or falling stars fly across and cut through the air. No fires except <the celestial ones> linger on their own territory—I am talking about the divine fires that the world maintains eternally, because they are its parts and its products. They are active, they move forward, they maintain their trajectory, and they remain constant. Would they not get bigger and smaller on alternate days if their fire suddenly accumulated for some reason or other? For it would be smaller or bigger depending

on whether it was fed more generously or more meanly. (3) I was just saying that no fire that flares up in some impurity in the air is long-lasting. Now I am going further: it cannot last and stand still at all, for torches, and lighting-bolts, and shooting stars, and any other kind of fire ejected by air are on the run and are not seen except while they are falling. A comet has its own position, and so is not emitted swiftly, but measures out its course; it is not extinguished, but makes an exit.

(24.1) "If it were a planet," someone says, "it would be in the zodiac." Who is imposing a single path on the planets? Who is forcing the divine within narrow limits? Indeed, these very stars that you all believe are the only ones that move each have different orbits. So why should there not be some that move away on a path of their own that is distant from the others? Why should there be no access to a particular region of the heavens? (2) But if you do think that no star can move unless it is in contact with the zodiac, a comet can have a different orbit, but one that coincides with the zodiac in part. This is not necessarily what happens, but it is possible. Just think: is it not more appropriate to the world's greatness for it to be divided into many paths as it rotates, and not to wear away one track while the rest of it lies idle? (3) Do you believe that, in this huge, immensely beautiful body, out of the countless stars that adorn the night with their varied beauty and will not let it be empty and inactive, there are only five that are permitted to take any exercise, while the rest stand still, a static, motionless population?

(25.1) At this point someone may ask me, "Why then has the course of these comets not been observed in the same way as that of the five stars?" I shall give him this answer: there are many things that we admit exist, but we do not know what they are like. (2) Everybody will agree that we have a mind, by whose commands we are driven on and called back. But what the mind is, this controller and master of ours, no one will explain to you, any more than he will explain where it is: one person will say that it is breath, another that it is a kind of harmony, another that it is a divine power, a portion of god, another that it is the finest part of the soul, another that it is an incorporeal power; someone will be found to say it is blood or heat.[34] So far from being able to acquire a clear grasp of other things, the mind is still trying to understand itself.

(3) So why are we surprised that comets, such a rare spectacle in the world, cannot yet be described by fixed laws, that neither their starting points nor their finishing points are yet known, seeing that they reappear after enormously long intervals? Fifteen hundred years have not yet passed since Greece "numbered and named the stars";[35] still today there are many nations that know only the outward appearance of the heavens, that do not yet understand why the moon is eclipsed, why <the sun> is darkened. Among us, too, reason has only recently found a reliable answer to these questions. (4) There will come a day when the passage of time and the efforts of a longer stretch of human history will bring to light things that are now obscure. One lifetime, even if it can be wholly devoted to astronomy, is not sufficient for the investigation of such important matters. And just think of how we divide our tiny number of years unequally between our studies and our vices. So it will take a long succession of people to explain these matters. (5) There will come a day when our descendants are astonished that we did not know such obvious facts. These five stars force themselves on our attention, and, as they constantly appear in different places, make us inquisitive; but what their morning and evening risings are, what are their stations, when they move straight ahead, why they are driven backward—all this we have only just begun to understand. Whether Jupiter was rising, or setting, or retrograde—for they have applied that term to his retreating—we learned just a few years ago. (6) People have been found telling us, "You are wrong to think that any star either halts its course or changes it. The celestial bodies cannot stand still or be turned aside: they all move forward; they proceed just as they first began. Their motion will end only when they do. The movements of this eternal structure are unalterable: if they ever stop, things that are currently conserved by their regularity and constancy will crash into each other." (7) Why is it, then, that some of them look as though they are going backward? The approach of the sun gives them an appearance of slowness, as does the nature of their paths and their orbits, so positioned that at a particular time they mislead observers; thus ships, though they are moving under full sail, nevertheless look as though they are standing still. One day there will be someone who demonstrates where comets have their orbits, why they wander so far from the rest, how big they are, and what they are like. Let us

be content with what has been discovered: let our descendants also contribute something to the truth.

(26.1) "We do not see through stars to things beyond," someone says, "but our eyesight passes through comets." First of all, if that happens, it happens not where the star itself is—it is made of dense, solid fire—but where a faint brightness extends and scatters like hair: you are seeing through gaps between the fire, not through the fire itself. (2) "All stars are round," the person says, "but comets are extended, which shows they are not stars." But who is granting you that comets are elongated? Their nature, like that of the other stars, is a sphere; it is their brightness that extends. The sun sends its rays out far and wide, but its shape is different from the shape of the light flowing from it. In just the same way, the bodies of comets are rounded, but their brightness seems longer than that of the other stars.

(27.1) "Why?" you ask. You first tell me why the moon displays a light so different from the sun's, although it receives it from the sun; why it is sometimes red, sometimes pale; why it has a grey, dark color when it is prevented from seeing the sun. (2) Tell me why all the stars to some extent have different appearances, quite distinct from the sun. Just as nothing prevents them from being stars, even though they are not similar, so nothing prevents comets from being eternal and of the same kind as the rest, even if they do not have a similar appearance. (3) And tell me: the world itself, if you think about it, is it not made up of contrasting components? Why is it that when the sun is in Leo it always blazes and bakes the earth with its heat; in Aquarius it freezes winter solid and blocks the rivers with ice? Both these constellations are essentially the same kind of thing, although they are dissimilar in effect and nature. Aries rises in a very short time, Libra appears very slowly. Yet both of these constellations have the same nature, though one ascends in a brief time, the other takes a long time to emerge. (4) Don't you see how the elements contrast with each other? They are heavy and light, cold and hot, wet and dry; all the world's harmony is created from disharmonious constituents. Do you say that a comet is not a star because its shape does not correspond to a particular model, and it is not like other stars? Of course you can see that the star that returns to its starting point thirty years later[36] is very similar to the one that revisits its home within a year![37] (5) Nature does not produce her creation

according to a single pattern, but rejoices in variety: she has made some things bigger than others, some faster, some stronger, some more moderate; she has separated some from the crowd, so that they move conspicuously, on their own, but has sent others to join the herd. Anyone who thinks that nature is not entitled to do something occasionally unless she does it often does not know nature's power. (6) Nature displays comets infrequently and assigns them a different place, different timetables, and motions unlike the rest: she wanted to enhance the grandeur of her creation with them too. Their form is too beautiful for you to regard it as the product of chance, whether you consider their size or their brightness, which is greater and fierier than the other stars. There is something special and unique about their appearance, which is not tightly constricted and contained, but freely spread out, covering the territory of many stars.

(28.1) Aristotle says that comets indicate stormy weather,[38] with severe winds and rain. So, do you not think that something that can foretell the future is a star? It is not a sign of stormy weather in the way that "sputtering oil and crumbly snuff collecting on the wick" are signs of future rain,[39] or in the way that it is a forecast of wild seas if "the sea birds play on dry land, and the heron abandons its familiar marshes and flies above the high cloud";[40] but in the way that the equinox is a sign of the year turning hot or cold, or in the way that Chaldaean prophecies indicate the sad or happy future that a star determines for people at their birth.[41] (2) To show you that this is so, a comet does not threaten wind or rain as soon as it appears, as Aristotle says, but it makes the whole year suspect; which shows that it does not derive signs from the immediate locality for the immediate locality, but it has signs laid down and provided for by the laws of the world. (3) The comet that appeared in the consulship of Paterculus and Vopiscus[42] did what was predicted by Aristotle and Theophrastus;[43] for there were violent, continual storms everywhere, while in Achaea and Macedonia cities were destroyed by earthquakes.

(29.1) "Their slowness," someone says, "proves that they are very heavy and contain a lot of earthlike material; so does their path, for they are usually driven toward the poles." Both arguments are wrong. I shall deal with the first one first. So, you say, what travels more slowly is heavy? What about Saturn, which completes its course most

slowly of all the planets? Is it heavy? No, the proof of its lightness is that it is higher than the rest. (2) "But," you say, "it goes round in a larger orbit, and does not go slower than the rest but further." It may occur to you that I could say the same about comets, even if their progress were more sluggish. But is not true that they go more slowly: for the most recent one crossed half the heavens within six months, and the previous one retreated within fewer months. (3) "But it is because they are heavy that they are driven lower." First of all, what is driven round is not driven down. Secondly, the most recent comet began its movement in the north, arrived in the south, via the west, and disappeared as it was rising higher; the Claudian one, first seen in the north, never stopped climbing steadily higher in a straight line until it vanished.

These are the views concerning comets that have excited other people or me: whether they are true, the gods know, for they possess knowledge of the truth. We are only permitted to grope around for it and to advance into the darkness by means of conjecture, with no confidence of discovering something—though not without hope.

(30.1) Aristotle said,[44] in admirable fashion, that we never need greater humility than when the gods are under discussion. If we enter temples with composure, if when we are going to a sacrifice we have a humble demeanor, we straighten our toga, and we assume every mark of modesty, how much more ought we to do this when we are arguing about the stars, about the planets, about the nature of the gods, in order to avoid making incautious or ignorant assertions, or knowingly making false statements! (2) Let us not be surprised that things buried so deeply take so long to unearth. Panaetius and others want comets to be thought of not as ordinary stars,[45] but as the deceptive appearance of a star. They should carefully examine whether every part of the year is equally adapted to producing comets, whether every region of the sky is suited to their generation, whether they can be seen wherever they can go, and so on. All these questions are eliminated when I say they are not fires that happen by chance but are integral to the world; it does not display them often, but it makes them move in invisible regions.

(3) How many things besides comets follow remote paths, never appearing to human eyes! For god did not make everything for human beings. How small a part of this vast creation is entrusted to us!

He who manages all this, who created it, who laid the foundations for it all and surrounded himself with it, and who is the greater and better part of his creation, he eludes our sight and must be perceived by thought. (4) Also, many things that are related to the supreme deity and have been assigned power akin to his are obscure; or perhaps, what may surprise you more, they both swamp our vision and elude it, whether they are so insubstantial that human sight cannot perceive them, or such greatness hides itself in holier seclusion, concealing its kingdom, that is, itself, and granting access to nothing except the mind. We cannot discover what this thing is without which nothing exists; and yet we are surprised that we know too little about some mere fires, when the greatest part of the world, god, is hidden!

(5) How many animals we have discovered for the first time in this generation, how many not even in this one! The people of a future age will know much that is unknown to us; much is being kept for the generations to come after memory of us has faded away. The world is a paltry thing unless it contains something for every age to discover. (6) Some holy secrets are not passed on all at once: Eleusis keeps things to reveal to those who come back;[46] nature does not pass on all its holy secrets at once. Do we think we have been initiated? We are stuck in the entrance hall. Those mysteries are not revealed indiscriminately or to everyone: they are kept back, locked up in the inner sanctuary, and our generation will see something, but the one that comes after us will see something else.

(31.1) So when will our knowledge encompass all this? Great enterprises progress slowly, especially if effort falters. We have not yet completed the one task to which we apply our whole minds—becoming as immoral as possible. Vice is still in progress. Luxury discovers something new to go crazy over, sexual immorality discovers a new indignity to inflict on itself, the moral collapse and corruption that stem from self-indulgence discover something more voluptuous, more sensuous, to die for. (2) We have not yet got rid of every trace of soundness; we are still stamping out any remains of good character. With our sleek, glossy bodies, we have overtaken female beauty treatments; we men wear prostitutes' colors that married women would not put on; we tiptoe along with delicate, mincing steps (we do not walk but parade); we adorn our fingers with rings; a jewel is arranged on every joint. (3) Daily we devise ways of damaging our masculin-

ity, so that it may suffer degradation since it cannot be discarded: one man cuts off his genitals, another escapes to the obscene section of the gladiators' school, and, when hired out to die, he chooses a shameless type of armor in which he can indulge his sickness even on the point of death.[47]

(32.1) Are you surprised that wisdom has not yet completed the whole of its task? Wickedness has not yet revealed itself completely; it is still coming to birth, and yet we are all at its service; our eyes, our hands are its slaves. But wisdom—who goes anywhere near that? Who thinks it deserves more than a passing acquaintance? Who takes any notice of a philosopher or of any of the liberal arts, except when the games are postponed, or when there is a rainy day that they feel like frittering away? (2) That is why so many philosophical lineages are dying out without a successor: the Academics, both the old ones and the newer ones,[48] have left behind no high priest. Who is there to hand on the teachings of Pyrrho?[49] The Pythagorean school, unpopular with the common people, cannot find a teacher. The new sect of the Sextii,[50] with its Roman vigor, died out while it was beginning, though it had started with a great impact. (3) But what enormous efforts people make to guard against the name of any pantomime actor disappearing! The house of Pylades and Bathyllus[51] is maintained by their successors; these skills find many students and many teachers. Private stages resound throughout the city: on them men and women waltz; males and married women compete to see who can move their hips more sensuously. Then when their brow has been chafed for a long while beneath a mask, they transfer to a helmet.[52] No one cares about philosophy. (4) Far from any discoveries being made on topics left inadequately researched by the ancients, many earlier discoveries are falling into oblivion. Yet, by Hercules, if we set about the subject with all our might, if young people sobered up and put their backs into it, if older people taught it, younger people learned it, we would hardly get to the bottom where the truth is located; at the moment we are scraping at the surface with feeble hands in our search for it.

<*On . . . Fires*>

(Praef. 1) In my opinion, Lucilius, excellent man, the difference between philosophy and other areas of study is as great as the difference, within philosophy itself, between the branch concerned with humans and the one concerned with the gods.[1] The latter is more elevated and more noble; it allows itself immense scope; it is not satisfied with the eyes; it suspects that there is something greater and more beautiful that nature has placed beyond its sight. (2) In brief, the difference between the two is as great as the difference between god and human beings: the one branch teaches what should be done on earth; the other what is done in the heavens; the one dispels our wrongdoings and brings a light up close to us so that the uncertainties of life can be clearly discerned; the other rises far above the darkness in which we stumble around, whisks us away from the shadows, and leads us to the source of light.

(3) I myself give thanks to nature whenever I see her not in her public aspect, but when I have entered her more remote regions, when I am learning what the material of the universe is, who is its creator or guardian, what god is, whether he is totally focused on himself or sometimes takes notice of us too,[2] whether he creates something every day or has created once and for all, whether he is part of the world or the world itself, whether even today he may make decisions and amend part of the law of fate, or whether it would be an impairment of his greatness and an admission of error to have made something that needed alteration. But the same course must necessarily seem right to him to whom only the best course can seem right, nor does that make him less free or powerful; for he himself is his own necessity.[3] (4) If I were not allowed access to these questions, it would not have been worth being born. For what could give me a reason to be glad that I had been included in the ranks of the living? Digesting food and drink? Stuffing full this body—which is vulnerable, delicate, and will perish if it is not constantly replenished—and living as nurse to a sick man? Fearing

death, the one thing to which we are born? Take away this invaluable blessing,[4] and life is not worth the sweat and the panic.

(5) What a despicable thing a human being is if he does not rise above human affairs! All the time that we are struggling with our passions, what is so wonderful about our achievement, even if we prevail? We are outdoing monsters: why should we be conceited because we are not as bad as the worst people? I cannot see why anyone who is more robust than the others in a hospital should be pleased with himself: (6) strength is quite different from good health. Have you broken free from moral vices? Your face does not have a feigned expression, your speech is not designed to please somebody else, nor are your feelings concealed, nor do you harbor greed, which denies itself what it has taken from others, nor luxury, which squanders money shamefully only to recoup it even more shamefully, nor ambition, which will bring you honors only by dishonorable means? You have not yet achieved anything: you have broken free from many things, but not yet from yourself.

The virtue to which we aspire is marvelous not because freedom from evil is in itself wonderful, but because it releases the mind, prepares it for knowledge of the celestial, and makes it worthy to enter into partnership with god. (7) It has consummated and fulfilled the blessings of human destiny only when it has trampled over every evil and has sought the heights and entered the inner recesses of nature. Then, as it wanders among the stars themselves, it takes delight in laughing at the paved floors of the wealthy and at the whole earth with its gold—I refer not just to what it has disgorged and given to the mint for stamping into coinage, but also to what it keeps hidden for the greed of posterity. (8) The mind cannot despise colonnades, and ceilings gleaming with ivory, and topiary forests and rivers channeled into houses until it has toured the entire world and until, looking down from on high at the earth—tiny, predominantly covered by sea, and, even when it rises above it, mainly uncultivated, and either burnt or frozen—it has said to itself, "This is that pinprick[5] that is carved up among so many nations by sword and fire!"

(9) How ridiculous are mortals' boundaries! The Dacians must not pass beyond the lower Danube; let the Thracians enclose their empire with the Haemus mountain, the Euphrates block the Parthians, the

Danube form the boundary between Sarmatian and Roman territory, the Rhine set a limit on Germany, the Pyrenees raise their ridge between the Gallic and Spanish provinces, uncultivated desert sands lie between Egypt and the Ethiopians.[6] (10) If someone gave human intelligence to ants, will they too not divide a single threshing-floor into many provinces? Once you have ascended to those truly great regions, whenever you see armies marching with standards raised, and, as though something great were happening, cavalry now protecting the rear, now exploring ahead, now spread out on the flanks, you will want to say, "The black column marches across the plain."[7] It is a mere scurrying of ants toiling in narrow confines. What difference is there between them and you apart from the size of your puny bodies? (11) It is a mere pinprick on which you sail, on which you wage war, on which you lay out your kingdoms, minute even when the ocean breaks on either side of them.[8]

Up above there are vast spaces, which the mind is allowed to enter and occupy, provided that it takes scarcely anything of the body with it, that it wipes away any uncleanness, and that it soars upward unencumbered, nimble, and self-reliant. (12) When it has reached those regions, it finds nourishment, it grows, and, as though freed from its chains, it returns to its origin. It has this proof of its own divinity, that it takes delight in the divine and enjoys it not as someone else's possession but as its own. For confidently it watches the settings and risings of the stars, and their differing but harmonious paths; it observes where each star first reveals its light to earth, where its zenith [the highest part of its course] is, to what point it descends.[9] As a fascinated spectator, it examines and inquires into each detail. (13) And why should it not inquire? It knows this all relates to itself.

It then despises the limitations of its previous dwelling. For what distance lies between the farthest coasts of Spain and the Indies? An interval of very few days, if a ship is driven by a favorable wind.[10] But that celestial region affords a journey lasting thirty years to a very swift star that never halts but is uniformly swift.[11] There the mind at last learns what it has long been inquiring into; there it begins to know god. What is god? The intelligence of the universe. What is god? All that you see and all that you do not see. Only then is his true greatness recognized—greatness than which nothing greater can be

imagined—if he alone is everything, if he controls his creation both from within and from without.[12]

(14) So what is the difference between god's nature and our own? The mind is the superior part of us; in him there is nothing apart from mind. He is nothing but reason, although such great error grips the mortal sphere that human beings think that the most beautiful, the most organized, the most reliable thing that exists is subject to accident,[13] at the mercy of chance, and therefore disorderly, with all the lightning-bolts, clouds, storms, and other things that batter the earth and the neighborhood of the earth. (15) And this foolishness is not confined to the uneducated, but it also affects those who profess wisdom.[14] There are people who think that they themselves have a mind, one that has foresight, administering in detail both its own and other people's affairs, but that this universe, in which we too find ourselves, is carried along without any plan by some haphazard process or by a nature that does not know what it is doing. (16) What value do you place on learning about these topics and determining the limits of everything? on learning how great god's power is; whether he forms matter for himself or employs matter that is provided for him; which is prior to the other—whether reason is secondary to matter or matter to reason; whether god achieves whatever he wants, or the material he must deal with lets him down in many cases, just as many things are formed badly even by a great craftsman, not because his skill is defective, but because the stuff he works with is often unresponsive to his skill? (17) To look into all this, to learn about it, to brood over it—is that not to transcend one's mortality and be re-registered with a higher status? "What use will that be to you?" you say. If nothing else, at least this: I shall know that everything is puny when I have measured god.

(1.1) Now, to proceed to my intended subject, hear what I think about the fires that the air drives across the sky.[15] That they are emitted by a great force is proved by the slanting direction of their motion and by their extreme rapidity; it is clear that they do not move but are hurled. The fires have many different shapes. (2) Aristotle calls one kind a goat.[16] If you ask me why, you must first explain to me why the Kids are so called.[17] But if, as is most beneficial, we can agree not to ask each other questions we know the other cannot answer, it

will be more satisfactory to investigate the phenomenon itself rather than to wonder why Aristotle called a ball of fire a goat. For such was the shape of the one that appeared, as large as the moon, when Paulus was waging war against Perseus.[18] (3) We also, more than once, have seen a flame in the shape of a huge ball, which was dispersed while in flight: we saw such a prodigy at the time of the departure of the deified Augustus;[19] we saw one at the time when Sejanus was dealt with;[20] and Germanicus's death was accompanied by a sign of that sort.[21] (4) You will say to me, "So are you misguided enough to think that the gods send signs predicting people's deaths, and that anything on earth is important enough for the world to be aware that it is perishing?" There will be another opportunity to discuss this question: we shall see whether everything follows a fixed order, and things are all interconnected, so that what precedes is either a cause or a sign of what follows; we shall see whether the gods take an interest in human affairs or the sequence of events itself gives clear signs indicating what it is going to do.[22]

(5) For now, I take the view that fires of this kind occur because the air is subject to violent friction when there is a movement of air toward another region, and it does not yield, but battles against itself. From this disturbance arise beams,[23] balls, torches, and fires. But when it collides more gently and, so to speak, is massaged, smaller lights are ejected, "and flying stars trail their hair."[24] (6) Then very tiny fires mark out a slender path and stretch it across the heavens. So no night is without spectacles of this sort, for it does not take a major disturbance in the air to produce them. In fact, to put it briefly, they are produced in the same way as lightning-bolts, but with less force: just as clouds colliding with moderate force produce lightning-flashes, and when driven by greater energy produce lightning-bolts, so when you exert less pressure on the clouds, or they are smaller, they emit correspondingly weaker lights. (7) Aristotle's explanation is as follows: [25] "The earth emits numerous, varied exhalations, some moist, some dry, some hot, some suited to generating fire." And it is not surprising if evaporation from the earth comes in all forms and is varied, since in the heavens also objects do not appear with a single color, but the redness of the Dog Star is more intense,[26] that of Mars more subdued, and there is no redness in Jupiter, whose bright-

ness is concentrated in pure light. (8) So, amid the great abundance of particles that the earth emits and drives into the upper regions, inevitably some that feed fire reach the clouds and can be set ablaze not only when they collide, but also when they are exposed to the sun's rays. For in our experience as well, wood-shavings sprinkled with sulphur catch fire across a gap. (9) So it is likely that when such material is concentrated among the clouds, it can easily be set alight, and smaller or greater fires are produced according as they have more or less force. For it is extremely foolish to think that stars either fall down or leap across the sky, or lose bits through force or friction: (10) for if that happened, by now there would be none left; for every single night large numbers appear to move and be transported in different directions. And yet each star can be found in its usual position, and the size of each remains constant. So it follows that these fires are generated below the stars and quickly die out because they lack a foundation and fixed location. (11) "So why do they not shoot across in daytime too?" What if you were to say that the stars do not exist in daytime because they are not visible? Just as they are hidden and occluded by the brightness of the sun, so too torches shoot across in the daytime as well, but the intensity of the daylight conceals them. However, if ever such a vast number shoots across that they can defend their own brightness even against the daylight, then they are visible. (12) Certainly our generation has more than once seen daytime torches, some flying from east to west, others from sunset to sunrise. Sailors think it a sign of a storm when a lot of stars fly across. But if that is a sign of winds, it occurs where winds come from, that is in the air, which is in between the moon and the earth.

(13) In a great storm there regularly appear something like stars resting on a ship's sail.[27] Those in danger then think that they are under the divine protection of Pollux and Castor. However, the grounds for their optimism are that the storm now appears to be losing its power, and the winds to be dropping; otherwise the fires would be moving, not resting. (14) When Gylippus was heading for Syracuse,[28] a star was seen to settle above his lance; in Roman camps spears have appeared to burn, no doubt because fires descended onto them. These can often strike both animals and trees like lightning-bolts, but if they possess less energy, they just glide down and settle, and do not

strike or wound. Some of them are ejected from between clouds; others from a clear sky, if the air was the kind that can emit fire. (15) For sometimes thunder comes from a clear sky too, for the same reason as from a cloudy one, because air collides with air: even if it is quite bright and dry, it can still gather and form bodies similar to clouds, and they produce a sound when they are struck. So when are beams formed, when are shields and images of huge fires? When a similar but more powerful cause acts on such material.

(2.1) Now let us see how the brightness that encircles stars is formed.[29] It is recorded that on the day when the deified Augustus returned from Apollonia and entered the city,[30] a circle of various colors, such as is usual in the rainbow, was seen around the sun. The Greeks call this a *halo*;[31] we can most appropriately talk of a garland. I shall explain how it is said to be formed. (2) When a stone is dropped into a pool, we see the water spread out in many circles: first a very small circle is formed, then a wider one, and then other larger ones, until the movement fades away and dissolves into the smoothness of motionless water. Let us think of something similar happening in the air too: when it becomes denser, it can experience a blow; when the light of the sun or the moon or any star encounters it, it forces it to recede in expanding circles. For liquid, air, and everything whose form is altered by an impact is forced into a shape like that of the thing that exerts force on it. Now all light is round; therefore the air too will assume that form when struck by light. (3) For this reason the Greeks have called these bright phenomena "threshing-floors," because the places designated for threshing grain are generally round. Now, we should not think that these things, whether they are threshing-floors or garlands, are formed close to the stars; for they are a great distance away from them, even though they appear to encircle and garland them. These shapes are formed not far from the earth, and our sight, deceived by its habitual weakness, thinks they are located around the star itself. (4) But nothing like that can be formed close to the stars and sun, because in that region there is fine aether. Shapes can be imprinted only on dense, close-packed bodies, but in fine bodies they have nowhere to settle or stick. (In the baths too, because of the darkness of the dense air, something like a garland can regularly be seen around a lamp, most often in a south wind, when the atmosphere is particularly heavy and dense.) (5) Sometimes they gradually dissolve

and disappear; sometimes they are severed at some point, and sailors expect a wind from the direction where the garland's continuity is disrupted: if it breaks in the north, there will be a north wind; if in the west, a west wind. This is evidence that these garlands are formed in the region of the sky in which winds too generally occur; higher regions do not have garlands because they do not have winds either.

(6) To this evidence add the following as well, that a garland is never formed except in stable air, when the wind is idle; in other conditions they are generally not seen. For stationary air can be pushed and pulled and formed into some shape; but light makes no impression at all on flowing air, for the air does not resist or change shape because each bit of it is dispersed in turn. (7) So no star will ever surround itself with such a shape except when the air is dense and motionless, and therefore receptive to the beam of round light that hits it. Understandably so—just remember the illustration I gave a short while ago: a pebble thrown into a pool or lake, or any confined water, produces countless circles. But it will not do the same in a river. Why not? Because fast-running water breaks up any pattern. So the same happens with air: air that stands still can take on a pattern, but air that is rushing and racing refuses to be controlled and disrupts every impact and the resulting shape.

(8) When these garlands that I have spoken about have dissolved evenly and have faded away just where they were, that indicates rest, peace, and tranquility in the air; when they have given way at one point, there is a wind from the direction where the break occurs; if they have been torn at several points, a storm is brewing. (9) The reason for this can be understood from what I have already explained. If the entire shape has faded, it is evident that the air is stable and therefore calm. If it is cut at one point, it is evident that air is bearing down from that side, and so that region will produce a wind. But when it is lacerated and ripped on all sides, plainly it is being attacked from numerous points, and unsettled air is assailing it from all directions. And so from this restlessness in the sky, as it attacks on so many fronts and struggles on all sides, it is evident that there will be a storm with numerous winds.

(10) These garlands will mainly be observed at night around the moon and the other stars, rarely in daytime—so rarely that some of the Greeks have denied they occur then at all, although historical

records prove them wrong. The reason for the rarity is that the sun's light is stronger, and the air itself, when stirred and warmed by the sun, is more rarefied. The power of the moon is weaker and so is more easily withstood by the surrounding air. (11) Similarly the other stars are feeble and cannot break through the air with their own strength, and so an image of them is formed and preserved in material that is more solid and less yielding. The air needs to be neither so dense that it excludes and repels the light that strikes it, nor so thin or rarefied that it offers no resistance to the incoming rays. This intermediate state occurs at night, when stars strike the surrounding air with a gentle light, not aggressively or harshly, and they color the air, which is denser than it normally is in daytime.

(3.1) On the other hand, rainbows do not occur at night, or only very rarely, because the moon is not powerful enough to pass through clouds and tinge them with the kind of color they receive when struck a glancing blow by the sun. For that is how they[32] generate the form of the multicolored rainbow: because in the clouds some bits are more swollen, some are lower, and some are too dense to allow the sun through, others too feeble to exclude it, this unevenness creates an alternating sequence of light and shadow, and generates the amazing variety of colors in the rainbow.

(2) Another explanation is given for the rainbow as follows: when a pipe bursts at some point, we see water forced out through the tiny hole; when it is sprayed against the obliquely angled sun, it displays the form of a rainbow. You will see the same thing happening if you ever feel like watching a launderer: when he has filled his mouth with water and lightly sprays the clothes that are spread out on stretching-frames, you can see various colors produced in the air that is filled with spray, like the ones that normally shine in a rainbow.

(3) You should be in no doubt that the cause of this phenomenon lies in moisture; for a rainbow never occurs except in cloudy conditions. But let us examine how it occurs. Certain people say that there are some raindrops that let the sun's light through, and others that are too compacted to transmit light; and so the first sort produce brightness, the second sort shadow, and hence, by the intermingling of the two, a rainbow is generated, in which part is bright, welcoming the sun, and part is darker, excluding it and casting a shadow over the immediate surroundings.

(4) Others reject this account. For it could be thought true if the rainbow had just two colors, if it consisted of light and shadow; but as things are,

> though a thousand different colors gleam,
> the transition between them deceives our watching eyes:
> for always the adjacent one is the same, but the furthest apart
> are different.[33]

In it we see a bit of red, a bit of yellow, a bit of blue, and other colors traced in slender lines, as in a picture; as the poet says, you could not tell whether the colors are different unless you compare the last with the first. For the juxtaposition is deceptive: through nature's wonderful handiwork, what starts out extremely similar ends up so extremely different. So what use are two colors, light and shadow, since an explanation is required for countless colors?

(5) Some people think the rainbow is produced as follows: in a region where it is already raining, the individual drops of falling rain are individual mirrors; so they individually emit an image of the sun. Then many, or rather innumerable, images, descending and plummeting, are merged together; so a rainbow is the merging of many images of the sun. (6) They argue as follows: "On a fine day," they say, "put out a thousand bowls:[34] they will all have images of the sun. Distribute drops on individual leaves: each individual drop will have an image of the sun. On the other hand, a large pool will have no more than one image. Why? Because every smooth surface that is confined and surrounded by a boundary is a mirror. So divide up a reservoir of enormous size by inserting walls: it will have as many images of the sun as it has pools. Leave it as it is: it will give you only one image. It makes no difference how tiny the amount of water or the lake is: as long as it has boundaries, it is a mirror. So those infinitely many drops that falling rain carries down are so many mirrors and contain so many likenesses of the sun. To someone facing them and looking at them, they appear confused, and the spaces between individual likenesses cannot be made out, for the distance prevents them from being distinguished. As a result, instead of individual likenesses, one confused likeness is seen emerging from all of them."

(7) Aristotle is of the same opinion:[35] "From every smooth surface," he says, "our sight bends back its rays. Nothing is smoother

than water and air; therefore our vision returns to us from dense air also. When our eyesight is dim and weak, it will fail on impact with any kind of air. So some people suffer from an infirmity that makes them appear to be walking toward themselves, and they see their own image everywhere. Why? Because their weak eyesight cannot even break through the air closest to them, but comes to a halt. (8) So any sort of air has the same effect on them as dense air has on other people; for air of whatever sort is strong enough to repel their feeble vision. Now water is far more effective at sending our vision back to us because it is denser and cannot be overcome; it slows down our eyes' rays and bends them back to where they have come from. So since there are many drops in rain, there are as many mirrors; but because they are small, they reproduce the color of the sun without the shape. Then since the same color is given off in countless drops falling without a gap, there begins to be the appearance, not of many separated images, but of one long, continuous image."

(9) "How," you ask, "can you tell me that there are many thousands of images where I can see none? And why, though the sun has only one color, is the color of the images varied?" In order to rebut the point you have made, and also other points that are no less in need of rebuttal, I ought to say this: nothing is more deceptive than our eyesight, not just with things that distance prevents it from examining minutely, but also with things it sees within easy reach: an oar has a shallow covering of water, and it gives the appearance of being broken; fruit is much bigger to someone looking at it through glass; a very long colonnade merges the intervals between the columns. (10) Go back to the sun itself: this object, which reasoning proves to be larger than the whole earth, our eyesight makes so small that wise men maintained that it was a foot across.[36] None of us sees the motion of the object that we know is fastest of all,[37] nor would we believe it was moving if it were not evident that it had moved. The world itself glides with feverish speed and brings risings and settings round again in a moment, but none of us is aware of its motion. So why are you surprised that our eyes do not distinguish the drops in rainfall, and that the difference between the tiny images disappears as we look from a great distance?

(11) Nobody can be in any doubt that the rainbow is an image of the sun formed in a cloud that is full of moisture and hollow. The

following should make this clear to you: the image is always opposite the sun, high up or low down depending on whether the sun has sunk or risen; it moves in the opposite direction, for if the sun is descending, the image is higher, if it is high, the image is lower. Often, though, such a cloud is alongside the sun and does not produce a rainbow, because it does not receive the image in a straight line.[38]

(12) The variety of color occurs for the simple reason that some of the color comes from the sun, some from the cloud. In this the liquid now produces blue lines, now green, now purplish, yellow or fiery, and two colors, subdued and intense, generate this variety. In the same way too purple cloth does not all emerge the same from the same purple dye: it makes a difference how long it is steeped for, whether the dye it absorbs is thicker or more dilute, whether it is immersed and boiled several times, or dipped just once. (13) So it is not surprising that, when there are two things, sun and cloud, that is, a body and a mirror, that the kinds of colors produced are as numerous as the kinds of intensification and weakening that they can undergo. For one color comes from fiery light; another from dim, gentler light.

(14) On other topics, research has no clear direction when we have nothing we can get a grip on, and free-ranging conjecture is required. In the present case it is clear that the rainbow has two causes, sun and cloud, because it never occurs in a clear sky, nor in a sky so cloudy that the sun is hidden. So it certainly derives from the things without either of which it does not exist.

(4.1) There is a further point, that it is equally obvious that the image is emitted like a mirror image, because it is never emitted except on the opposite side, that is, except when the object that appears is on one side, and the object that displays it is on the other. Arguments that are not just persuasive but compelling are adduced by the geometricians, and no one can be left in any doubt that the rainbow is an image of the sun that is poorly reproduced because of the faultiness and shape of the mirror.[39] Let us for the time being try other proofs that can be read at ground level.[40] (2) Among the proofs that the rainbow is generated in this way, I put the fact that it is generated very quickly. For a huge, many-colored object is woven across the sky in a moment and vanishes just as quickly; but nothing is given off as quickly as an image from a mirror, for it does not create something but displays it.

(3) Artemidorus of Parium even says what kind of cloud is required to produce such an image for the sun:[41] "If you make a concave mirror," he says, "that is a segment of a cutaway sphere, then, if you stand outside its center, anybody standing next to you will appear upside down and nearer to you than to the mirror. The same thing," he says, "happens when we look at a round, concave cloud from the side, namely, that the sun's image is detached from the cloud and is nearer to us and turned more toward us. It gets the fiery color from the sun, the blue from the cloud, and the other colors are a mixture of the two."

(5.1) People argue against this view as follows: "There are two opinions about mirrors: some people think that representations are seen in them, that is, forms of our bodies that are emitted from our bodies and are distinct from them; others say that not images but the bodies themselves are seen in a mirror, as the eye-beam is twisted round and bent back upon itself. (2) For the present it makes no difference how we see what we undoubtedly do see, but, however it happens, an image that is similar must be given off from the mirror. But what is as dissimilar as the sun and a rainbow, in which neither the shape of the sun, nor its color, nor its size, is visible? The rainbow is far larger, and, where it is bright, it is far redder than the sun; and in respect of its other colors, it is quite different. (3) Then, when you require air to have the properties of a mirror, you must show me the same smooth body, the same evenness, the same brightness. Yet no clouds bear any resemblance to a mirror: we often pass through the middle of them, but do not see ourselves in them; those who climb mountain tops look at clouds, yet do not see their image in them.

(4) "'Individual drops are individual mirrors.' I grant that, but I deny that a cloud is composed of drops. They contain something from which drops can be formed, not actual drops; a cloud does not contain water either, but the material for future water. (5) Suppose we concede both that there are innumerable drops in clouds and that they give off an image: still they would not all give off a single image, but individual drops would give individual images. Or again, join mirrors together: the images will not merge into one, but each will embrace within itself a likeness of the observed object. There are some mirrors composed of many tiny mirrors. If you place one person in front of them, a nation is visible, as each segment generates its

own shape; although the mirrors are joined together and contiguous, nevertheless they keep their images separate, and from one person they create a crowd; they do not amalgamate the mob, but keep it divided up into individual shapes. But the rainbow is bounded by a single outline, and the whole thing possesses a single shape.

(6) "'Tell me, now,' someone says, 'isn't there also often some resemblance to the colors we see in a rainbow when water is sprayed from a burst pipe or splashed up by an oar?' That is true, but not for the reason that you want to be accepted, that each individual drop forms an image of the sun. For the drops fall too quickly to be able to form images; they need to stay still in order to absorb what they are copying. So what happens? They take on the color, not the image. In any case, as Nero Caesar says most elegantly, 'the collar of the Cytheran's dove shines when it moves,'[42] and the peacock's neck gleams with different colors whenever it turns. So are we going to say that feathers of this sort, whose every movement turns into new colors, are mirrors? (7) Clouds are no less different in nature from mirrors than are the birds I have mentioned and chameleons and certain animals whose color alters. This is caused either by their own agency, when, inflamed with anger or desire, they change their skin-color as a fluid spreads beneath the surface; or by the angle of the light, since their coloring depends on whether it falls on them vertically or obliquely.

(8) "What similarity is there between mirrors and clouds? For the former do not transmit light, the latter let light pass through; the former are dense and compacted, the latter rarefied; the former are all made of the same material, the latter are random assemblages of diverse constituents, which makes them unstable and unlikely to hold together for long. Besides, at sunrise we see part of the sky go red, we sometimes see clouds of a fiery color; so, just as they receive this one color from an encounter with the sun, what is to stop them from absorbing many colors, even though they do not have the properties of a mirror?

(9) "Just now," the person says, "you included among your arguments that the rainbow is always brought into existence on the opposite side to the sun, because an image is not given off from a mirror either unless it is directly in front. This point," he says, "is agreed between us: for just as the object whose image is to be transferred

to the mirror must be placed opposite to it, so, to enable the clouds to be colored, the sun must be suitably placed for this purpose; for it does not have the same effect irrespective of what direction it shines from, and for this purpose the rays need to fall in the appropriate way." (10) This is what is said by those who argue for the view that the cloud becomes colored.

Posidonius and those who think that this kind of phenomenon is produced by mirror-reflection reply as follows:[43] "If there were any color in the rainbow, it would last and could be viewed more distinctly the closer one got. As it is, the image of a rainbow is clear from a distance, but disappears when one gets up close." (11) I do not agree with this objection, although I approve of the theory itself. Why? I shall tell you: because the cloud is indeed colored, but in such a way that its color is not visible from all sides. For the cloud itself is not visible from all sides either; for no one who is inside a cloud can see it. So why is it surprising if its color cannot be seen by someone by whom the cloud itself cannot be viewed? Yet the cloud, although it cannot be seen, does exist; so the same goes for its color. So it is not an argument for the color not being real that it stops being visible as people approach it. For the same thing happens with the clouds themselves, and they are not unreal because they cannot be seen.

(12) Besides, when you are told that the cloud is dyed by the sun, you are not being told that the color has been imprinted as if on a hard, stable, enduring body, but as on a fluid, changeable one, which allows no more than a short-lived display. Also, there are some colors that reveal their intensity at a distance: the better the quality of Tyrian purple cloth and the more deeply dyed it is, the higher you need to hold it up so that it can display its bright color. But one cannot infer that it does not possess the color—it does possess an excellent one—simply because it does not reveal it irrespective of how it is spread out.

(13) I am of the same opinion as Posidonius and consider that a rainbow is formed in a cloud shaped like a concave, round mirror, in the shape of a section of a sphere. This cannot be proved without the help of geometricians, who use arguments that leave no room for doubt to demonstrate that it is a copy of the sun, but not a close resemblance. (14) For not all mirrors stick to the truth: there are some

you would be afraid to look at (they give such a deformed image, distorting the appearance of the people looking into them, maintaining a resemblance, but a corrupt one); there are some where you feel pleased with your strength when you look in them (the biceps grow so big, and the whole body's physique is increased to superhuman size); there are some that show the right hand side, some the left, some that distort and invert. So why is it surprising that in a cloud too there should be a mirror of a kind that gives off a defective likeness of the sun?

(6.1) Further arguments include this one also, that a rainbow is never larger than a semicircle, and that the higher the sun, the smaller it is.

As our Virgil says, "and the huge rainbow drinks" when rain is approaching.[44] But its threats vary depending on what side it appears from: if it rises in the south, it will bring a large quantity of rainwater (for the clouds could not be overwhelmed by the very strong sunlight, so powerful are they); if it shines somewhere in the west, there will be dew and light rain; if it rises due east or thereabouts, it promises clear skies.[45]

(2) "Yet why, if the rainbow is an image of the sun, does it appear much bigger than the sun itself?" Because one kind of mirror has the property of displaying what it sees on a much bigger scale and enlarging shapes to a monstrous size; conversely, another kind diminishes them. (3) Tell me this: why does the image form a circle unless it is a reflection of a circle? Maybe you will explain where it gets its variegated color from, but you will not explain where it gets such a shape unless you point to some model on which it is based. There is no model except the sun; since you too admit that it gets its color from the sun, it follows that it gets its shape from there too. And then you and I agree that those colors that paint the whole sky come from the sun, but we disagree on this one point: you say that the color is real; I say it is apparent. Whether it is real or apparent, it comes from the sun. You will not account for the <sudden appearance and> sudden cessation of that color, since intense brightness always <both forms gradually> and disperses gradually. (4) Its rapid appearance and rapid demise is in my favor. For this is a peculiarity of the mirror, that what appears in it is not assembled bit by bit, but

comes into existence instantly in its entirety. Every image in a mirror vanishes just as quickly as it is put together; for to produce or remove them, nothing is required apart from their being displayed and being withdrawn. So in that cloud there is no real material and no body, but an illusion and a resemblance without substance. You want to be sure that this is so? The rainbow will cease if you cover over the sun. Put a second cloud in front of the sun, I tell you, and the rainbow's colorfulness will disappear.

(5) "But the rainbow is considerably larger than the sun." I said a moment ago that mirrors are made that magnify every body they copy. I shall add that everything is much larger when one is looking through water: writing, however tiny and difficult, is seen larger and clearer through a glass sphere full of water; fruit appears more beautiful than it is if it is swimming in a glass bowl; the stars themselves seem larger when one looks at them through a cloud, because our eyesight falters in moisture and cannot reliably grasp what it wants to. This is plain if you fill a cup with water and drop a ring in it: for although the ring is lying on the bottom, its image is emitted on the surface of the water. (6) Anything seen through moisture is much larger than in reality. Why is it surprising that an enlarged image of the sun is emitted when it is seen in a moist cloud, since there are two causes of the phenomenon? Because in the cloud there is something resembling glass which can transmit light, and there is also some water—or even if it does not yet contain water, it is forming water, that is, it has already virtually reached the state that it is changing into from its current state.

(7.1) "Since you have mentioned glass," someone says, "I shall use it as the basis for an argument against you. A small rod, grooved, or angular and knobbly like a club, is commonly made out of glass; if sunlight strikes this obliquely, it emits the kind of color seen in a rainbow, so that you can tell this is not an image of the sun but a change of color produced by deflection." (2) First of all, many aspects of this argument are in my favor: it is clear that the phenomenon is produced by the sun; it is clear that there must be something smooth, like a mirror, to deflect the sun; then it is clear that no color is created, but only the semblance of a counterfeit color, such as a dove's neck first assumes, then discards, as I said,[46] depending on how it is angled. This also occurs in a mirror, in which no color is implanted, but only

a representation of something else's color. (3) I have to explain just one thing: that the sun's image cannot be seen in that kind of glass rod. But it is incapable of reproducing the image properly; it does try to give off an image, because its material is smooth and suitable for the purpose, but it cannot do so, because its shape is irregular. If it were manufactured in the right way, it would give off as many suns as it had knobbles. Since these are distinct from each other but are not broad enough to function as mirrors, they produce only an attempt at an image, not the real thing, and because they are so close together, they blur the images and create the impression of a single color.

(8.1) "But why does a rainbow not form a complete circle, but only a semicircle is seen, even when it is at its fullest extent and curvature?" Some people take the following view: "Since the sun is much higher than the clouds, it strikes them only from above; consequently their lower part is not colored by the light. So since the sun's light falls on one part of them, they copy one part of it, and that is never more than half." (2) This argument is not very strong. Why? Because, although the sun is above, it nevertheless strikes the whole cloud and so colors the whole. And why not, since it often makes its rays pass through a cloud and forces its way through all its denseness? Then they are saying something that contradicts their own position. For if the sun is higher and so shines only on the higher parts of clouds, the rainbow will never reach down to the earth; yet it does come right down to the ground. (3) Besides, the rainbow is invariably opposite to the sun; it makes no difference whether it is above or below, because the whole side facing the sun is struck by the light. Next, sometimes the sun produces a rainbow even when it is setting: then at least it strikes the cloud from below, being close to the earth. Yet even then there is a semicircle, although the sunlight is reaching the clouds from a low position and a murky one.

(4) Our people, who claim that light is emitted in a cloud just as in a mirror, make the cloud concave, a section of a sphere; and this cannot give off an entire circle because it itself is only part of a circle. I support their theory, but I do not agree with this argument. For if a concave mirror can produce a complete image of a circle placed in front of it, there is nothing to stop a complete sphere being seen in a hemispherical mirror.

(5) We have also said that circles similar to a rainbow appear round the sun and moon.[47] Why is that circle complete, but it never is in a rainbow? Again, why is it always concave clouds that absorb the sunlight, never flat or bulging ones?

(6) Aristotle says that after the autumnal equinox a rainbow can form at any time of day,[48] but in summer it can form only when the day is either beginning or drawing to a close. The explanation for this is obvious: first, because in the middle part of the day the sun is very hot and overwhelms the clouds, and cannot receive its image back from clouds that it is breaking up; but in the early morning or when sinking toward sunset, it has less power, and so the clouds can withstand it and send it back. (7) Again, the sun does not usually form a rainbow except when opposite to the clouds in which it forms it; therefore, when the days are shorter, it is always at a low angle, and so at any point in the day, even when at its highest, it finds some clouds that it can strike from the opposite side of the sky. But in summertime it travels above our heads; and so in the middle of the day it is extremely high up and looks down on earth at too vertical an angle for an encounter with any clouds to be possible; for it then has them all beneath itself.

(9.1) The next topic for discussion is rods,[49] which are no less colorful and variegated, and which we are equally used to treating as signs of rain. There is no need to expend much effort on them, because rods are nothing but incomplete rainbows. For their appearance is colored, but not curved: they lie in a straight line. (2) They are formed next to the sun, generally in a cloud that is moist and already forming raindrops. So in them there is the same coloring as in a rainbow; only the shape is altered, because the clouds in which they are stretched out also have a different shape.

(10) There is similar variety of color in garlands,[50] but the difference is that garlands occur everywhere, wherever there is a star, whereas rainbows occur only facing the sun, and rods only in the vicinity of the sun. I can also express the difference between them all as follows: if you divide up a garland, the result will be a rainbow, if you straighten it out, it will be a rod. They all have complex coloring, with various combinations of blue and yellow. Rods are found only next to the sun; rainbows are solar and lunar; garlands are found with all the stars. **(11.1)** Another kind of rod appears when rays of light,

slender, intense, and distinct from each other, are projected through narrow apertures in the clouds; they too are signs of rain.

(2) At this point how am I to conduct myself? What should I call them? Images of the sun? Historians call them suns and record that two or three have appeared at once. The Greeks call them *parhelia*, because they are seen quite close to the sun, or because they tend toward some resemblance to the sun.[51] For they do not imitate it completely, just its size and shape. Also they have no heat, being feeble and weak. What name are we to give them? Do I do what Virgil does? He hesitated over a name, then used what he had hesitated over:

> And by what name shall I tell of you,
> Rhaetian wine? But do not on that account compete with
> Falernian cellars.[52]

(3) So nothing prevents them from being called parhelia. They are images of the sun in a cloud that is nearby and dense like a mirror. Some people define a parhelion as follows: a round, bright cloud that resembles the sun. For it follows the sun and is never further away than it was when it appeared. Is any of us surprised at seeing a copy of the sun in some spring or still lake? I think not. Yet an image of it can be given off up in the sky just as well as at our level, so long as there is material suitable for doing so.

(12.1) Whenever we want to detect an eclipse of the sun, we set out bowls, which we fill with either olive oil or pitch, because a dense liquid is less easily disturbed and so preserves the images it receives. Images cannot be seen except in something clear and motionless. Then we regularly observe how the moon gets in front of the sun; by interposing its body, it eclipses the sun (though the sun is so much bigger), sometimes partially, if it happens to overlap the edge of the sun, or sometimes completely. This is called a total eclipse; it makes the stars visible too and interrupts the daylight. Obviously this occurs when both spheres are in alignment with the earth. (2) So just as an image of each of them can be seen on earth, so it can in the air, when the air is of such a compacted and clear consistency that it receives a likeness of the sun. Other clouds receive one too, but they let it pass by if they are either moving, or rarefied, or dirty: moving clouds scatter the likeness; rarefied ones let it pass through; dirty, impure

ones are not aware of it, just as in our experience tarnished surfaces do not give off images.

(13.1) Two or more parhelia sometimes occur at once, and the explanation is the same. For what is to prevent there being as many of them as there are clouds capable of displaying a likeness of the sun? Some people take the following view: whenever two such representations arise, they think that one of them is an image of the sun, the other an image of the image. For in our experience also, when several mirrors are arranged so that one has sight of another, they are all filled with images, and one image comes from the real thing, but the rest are copies of images. It does not matter what it is that is displayed to a mirror: whatever it sees, it sends back. So, high up in the sky as well, if by some chance clouds are arranged so that they have sight of each other, one cloud sends back an image of the sun, the other an image of the image. (2) The clouds that produce this effect need to be dense, smooth, bright, flat, *** the sun.[53] Therefore all representations of this sort are bright and resemble discs of the moon, because they shine as a result of reflection, receiving the sunlight at an oblique angle: for if the cloud is below the sun and too near, it is dispersed by it; but if it is far away, it will not send back its rays or produce an image. For in our experience too, mirrors do not give off images of us when they are a long way removed from us, because our eyesight is unable to return all the way back to us. (3) These suns (I shall use the historians' terminology)[54] are also indicators of rain showers, especially if they form in the region of the south wind, the source of particularly dense clouds. When the sun is flanked on either side by such an image, if we believe Aratus,[55] a storm is brewing.

(14.1) It is time to run through other kinds of fire as well. They have various shapes: sometimes a star shoots across; sometimes there are conflagrations, at times fixed and steady, at times unstable. Many types of these can be seen: there are "wells," when there is a surrounding garland, as it were, and inside there is a huge recess in the sky, looking as though a circular cave has been dug out; there are "jars," when a huge, round mass of fire, resembling a large pot, either moves along or burns in one spot; there are "chasms," when a stretch of the sky has receded and, as it were, gapes open, displaying flames deep down. (2) These all come in many colors: some are a very intense red;

some have a weak, pale flame; some have a bright light; some pulsate; some are a uniform yellow with no discharges or rays emerging.[56]

So we see "long tracks of flames gleaming in their wake."[57] (3) These quasi-stars appear suddenly and fly past, and seem to leave a long trail of fire because of their immense rapidity, since our eyesight cannot discern their movement across the sky but thinks that the whole path they have traversed is made of fire. So great is the speed of their movement that its stages cannot be distinguished; only its sum total can be grasped: we realize where the star has gone rather than where it is going. (4) So it marks out its entire course as if with a continuous fire, because the slowness of our sight cannot keep up with its movements as it flies but sees simultaneously both where it suddenly appeared from and where it has finally got to. The same happens with lightning-bolts: their fire seems extended to us because it traverses its course swiftly, and the whole of its downward path impinges on our eyes at once. But the fire does not have a body that extends across the whole of its course, for objects as long and thin as that cannot have a powerful impact.

(5) So how do they suddenly emerge? A fire is set alight by friction in the air and propelled rapidly by wind. Yet it is not always caused by wind or friction: sometimes it also starts because the air is in a suitable condition. For up above there is a lot of dry, hot, earthy matter, in which fire breaks out and descends, following its fuel; and so it is swept along rapidly. (6) "But why is the color varied?" Because it depends on the nature of what is set on fire and on the size and power of the force by which it is set on fire. Moving objects of this sort indicate wind coming from the region from where they emerge.

(15.1) "How," you ask, "do the bright objects that the Greeks call *sela* occur?"[58] In many ways, so they say: powerful winds can produce them; so can the heat of the upper sky (for since fire is distributed so widely, it sometimes ignites things lower down, if they are inflammable); the movement of the stars can cause a fire with its swift progress and transmit it to lower regions. And besides, can it not happen that the air forces a powerful fire up as far as the aether, producing a bright object, or a conflagration, or the emergence of something like a star? (2) Of these bright objects, some travel headlong like

shooting stars; some remain in a particular place, giving off enough light to banish darkness and restore daylight until their fuel is used up. Then first they become fainter; next, like a flame collapsing on itself, by steady contraction they are reduced to nothing. Some of them appear within clouds; some above the clouds, when dense air, after it has long fed fire closer to the ground, forces it up as far as the stars. (3) Some of these do not tolerate delay but race past or else are immediately extinguished where they blazed up. These are called bright objects, because their appearance is brief and short-lived. But their descent is not harmless; for they have often caused damage like lightning-bolts. Things touched by them we call <star-struck>, which the Greeks call *asteroplêcta*. (4) But when they last longer, and their fire is stronger, and they follow the motion of the heaven, and even keep to their own paths, our people think they are comets, which have been discussed.[59] There are different types, "bearded," "cypresses," "torches," and all the others whose fire is dispersed behind them. It is uncertain whether one should include here "beams" and "jars," which are rarely seen; for they need a great concentration of fire, since their huge circumference is considerably greater than the size of the early morning sun. (5) You may include here something we frequently read about in historical works, that the sky appeared to burn; sometimes the burning is so high up that it seems to be among the stars; sometimes so low down that it looks as though something is on fire in the distance. In the reign of Tiberius Caesar, cohorts rushed to the assistance of the colony at Ostia as though it was on fire when there had been burning in the sky for much of the night—not very bright, but with a dense, smoky fire.

(6) No one doubts that these phenomena contain the flame that they display: they have a definite reality. But regarding the phenomena discussed earlier (I mean the rainbow and garlands), there is a question whether they deceive our eyes and consist of an illusion, or in them too what is seen is real. (7) We do not agree that underlying the rainbow or garland there is any definite body, but we consider that here we have the deceptiveness of a mirror, which simply creates the illusion of a separate body. For what is shown in a mirror does not exist; otherwise it would not disappear or be instantly overlain by another image, nor would countless shapes vanish one moment and be captured the next. (8) So what are they? They are semblances, an

empty imitation of real bodies that themselves are corruptly distorted by things so constituted as to have that effect. For, as I have said,[60] there are mirrors that deform the appearance of those who look at them, and there are some that enlarge them immeasurably, so that they exceed human stature and the scale of our bodies.

(16.1) At this point I want to tell you a story, so that you may learn how lust does not disdain any means of stimulating pleasure and applies its ingenuity to encouraging its own madness. There was a certain Hostius Quadra who turned his obscenity into a dramatic spectacle. The deified Augustus judged that this rich, miserly man, a slave to his own hundred millions, did not deserve to be avenged after he had been killed by his slaves; he virtually declared that he had been lawfully executed. His impurity was not confined to one sex, but he lusted after men as well as women. He made mirrors of the type I have just described, giving off greatly magnified images, in which a finger appeared longer and thicker than an arm. He arranged them so that, when he was submitting to a man with his back to him, he could see his partner's every movement in a mirror; and then he delighted in the illusory size of his member as though it were real. (3) He used to go recruiting in all the bath-houses and selected men after openly sizing them up; but all the same he used to thrill his insatiable vice with deceptions as well. Go on then, tell us that mirrors were discovered so that we could look presentable! It is disgusting to speak of what that monster, who ought to have been torn to pieces by his own mouth,[61] said and did when mirrors were placed all around him, so that he could be a spectator of his own enormities and could fill not just his mouth but his eyes with things that burden the conscience even when kept secret, things that anyone would deny having perpetrated even to himself. (4) Yet, by Hercules, wickedness does shrink from the sight of itself. Even in depraved people who are exposed to every kind of shame, there is a sensitive modesty when it comes to the eyes. But that man, as though it were not enough to submit to unheard of, unknown things, invited his eyes to watch; not content with a direct view of the extent of his wrongdoing, he surrounded himself with mirrors in which he could distribute and exhibit his shocking acts; and because he could not watch so attentively when he had lowered his head and fastened onto someone else's groin, he displayed his efforts to himself in images.

(5) He watched the lust of his own mouth; he watched the men whom he admitted at all points simultaneously; sometimes he shared himself out between a male and females, and as he passively submitted his whole body to them, he watched those unspeakable acts. What on earth did that impure man leave to do in the dark? He was not afraid of the daylight, but he exhibited to himself, he commended to himself, those monstrous couplings. Would you not expect that he even wanted to have his picture painted in the act?

(6) Even prostitutes have a certain modesty, and those bodies that are exposed to public derision cover themselves with something to hide their tragic submissiveness. So in some ways even brothels are decorous. But that monster had turned his own obscenity into a spectacle, and he exhibited to himself things that no night is dark enough to hide. (7) "I submit," he said, "to a man and a woman at the same time. Nevertheless even with the part of me that is so far redundant I act the man for someone's humiliation. All my members are occupied in acts of debauchery: let my eyes have a share in my lust as well and be its witnesses and inspectors. Even the things that are kept out of sight by the structure of our bodies should be made visible by technology, so that no one can think I do not know what I am doing. (8) Nature wasted her time, being so mean with the assistance she gave to human lust and organizing the coupling of other animals better. I shall find a way of both deceiving and satisfying my obsession. What use is my wickedness if my wrongdoing keeps within nature's limits? I shall surround myself with the kind of mirror that gives off incredibly large images. (9) If I could, I would make them real; since I cannot, I shall feed on the illusion. Let my obscenity see more than it is capable of; let it be astonished at the things it submits to." What an outrage! He was perhaps killed too quickly, before he could see it: he ought to have been sacrificed in front of his own mirror!

(17.1) Now let people mock philosophers because they discuss the nature of mirrors, because they ask why our appearance is sent back to us, why it faces toward us, what nature was thinking of when, after producing real bodies, she also wanted likenesses of them to be seen, (2) what was the point of producing this material capable of receiving images. It was not, surely, so that we could pluck our beards in front of a mirror, or so that we men could make our faces smooth: she has never in any way served the interests of luxury. No, first of all, because

our eyes were too feeble to tolerate looking straight at the sun and would not have known its shape, she displayed it with a weakened light. For although one may study the sun when it is rising and setting, still, we would not know about its true appearance when it is shining with white light and not red unless it appeared to us more gently, and easier to look at, in some liquid. (3) Besides, we would not see the encounter of two heavenly bodies that regularly interrupts the daylight, and we could not know what it was that withheld the sunlight though no cloud was in the way, unless we saw the images of the sun and moon more readily on the ground. (4) Mirrors were invented so that human beings might know themselves, and this leads to many benefits—first of all self-knowledge, then guidance for particular circumstances: for the handsome person, to avoid dishonor; for the ugly person, to realize that virtue must compensate for bodily imperfections; for the young man, to be reminded by his youthful beauty that this is the time for learning and for courageous enterprises; for the old man, to put aside what is inappropriate for gray hairs and to reflect on death. These are the reasons that nature gave us the opportunity to see ourselves.

(5) A clear spring or a smooth rock offered each person a reflection: "Recently I saw myself down on the shore, when the sea stood unmoved by the winds."[62] What do you think was the lifestyle of people who arranged their hair in front of this kind of mirror? That more innocent age, which was content with what came to hand, did not yet distort benefits into vices and did not appropriate nature's discoveries for the sake of lust and luxury. (6) First of all, chance revealed each person's appearance to them; then when the self-love that is innate in mortals made the sight of their own appearance pleasurable, they looked down more often at the things in which they had seen their reflection. After a degenerate people went below the earth itself to dig up what should have been buried, iron was used first (and humans would have come to no harm when they unearthed it if they had unearthed it alone); then afterward they used other evils from the earth.[63] People noticed their reflections on their smooth surfaces when they were busy with something else—one person saw it in a cup, another in a bronze vessel made for other uses, and soon discs were made for this very purpose, not yet from gleaming silver, but from fragile,[64] cheap material.

(7) The men of old lived unrefined lives and were smart enough if they used a river current to wash away the dirt accumulated during their work. Even in those days they took care to arrange their hair and comb their protruding beards, but they all did this for themselves, not for each other. Even wives never handled their husbands' hair, which back then men were in the habit of growing long; they looked handsome without any help from experts and tossed their hair just as noble animals toss their manes. (8) Later, as luxury gained control, mirrors as big as the whole body were made from engraved gold and silver, and later on they were decorated with jewels. One of these cost a woman more than the value of the dowries of her ancient counterparts, including the dowries given at public expense to the children of impoverished generals. Do you think that Scipio's daughters possessed a gold-plated mirror, when their dowry was paid in old copper coinage? (9) O blessed poverty that left room for such glory! If they had possessed one, they would not have received that dowry. But whoever it was who had the senate for father-in-law, he realized that he had received a dowry that it would not be right to hand back.[65] Today the dowry that *** gave ***[66] would not pay for a single mirror for the young daughters of freedmen. (10) For luxury has gradually got worse, enticed onward by wealth itself; vice has increased vastly; and so indiscriminate is recourse to all sorts of treatments that what used to be called female toiletries are now standard male equipment—for all men, I tell you, even soldiers. Is a mirror now used just for the sake of our appearance? No, it has become essential for any and every vice.

<*On Lightning and Thunder*>

(1.1) The entire investigation of the universe is divided into the study of the heavens, the air, and the earth. The first part examines the nature of the heavenly bodies and the size and shape of the fires by which the world is surrounded: whether the heaven is solid and made of hard, dense matter, or woven from delicate, fine matter; whether it undergoes motion or causes it;[1] and whether it has the stars beneath itself or bedded in its structure; how it maintains the seasons of the year and turns the sun back;[2] and further questions of this sort. (2) The second part deals with things that go on between the heavens and the earth. Here are clouds, rain, snow, <winds, earthquakes, lightning-bolts>, "and thunder that will stir up human minds,"[3] everything the air does or has done to it. We call these things "high up"[4] because they are more elevated than the lowest level. The third part investigates water, earth, trees, plants, and, to use the lawyers' term, everything that is connected to the soil.

(3) "How come," you say, "that you included the study of earthquakes in the place where you are going to talk about thunder and lightning-bolts?" Because, since a quake is produced by breath, and breath is air set in motion, even if it goes beneath the earth, it should not be considered there: it should be examined in the place that nature allocated to it. (4) I shall tell you something that you will find even more surprising: earth will have to be discussed in the context of the heavens. "Why?" you ask. Because we discuss topics concerning the earth itself in its own place: whether it is broad, unsymmetrical, and irregular in shape, or it all tends toward the shape of a ball, and moulds its parts into a sphere; whether it binds the waters or is bound by them; whether it is a living creature or a lifeless body without sensation, filled with breath, but not its own;[5] and so on. Whenever such questions are being handled, they will stay with the earth and be put in the lowest category. (5) But when one is inquiring what is the earth's location, in which part of the world it has settled, what its position is relative to the stars and heavens, this inquiry will defer to the higher-ranking ones and, so to speak, will acquire a superior status.

(2.1) Since I have spoken about the parts into which all of nature's matter is divided,[6] some general points need to be made: and this must be taken on board first, that air is one of the bodies that possess unity. You will realize what this means and why it needs to be established at the outset if I go into the topic a bit more deeply and say that some things are continuous, some composite.[7] Continuity is the joining together of parts without any gap; <compositeness> is contact between two bodies that are joined together; unity is continuity without compositeness. (3) Can there be any doubt that of the bodies that we see and handle, that either *are* perceived or *can* be, some are composite (they are formed by either binding, or accumulation, <or construction>, for example, a rope, a heap of grain, a ship), while others are not composite (such as a tree or stone)? So you must agree that in the case of things that elude our senses but are grasped by reason, some of these too possess bodily unity. (4) See how I am making things easier on your ears: I could have solved my problem if I had been willing to use philosophers' jargon and talk of unitary bodies. Since I am sparing you that, do me a favor in return. "How do you mean?" Whenever I say "one," remember that I am referring not to quantity but to the property a body has of cohering not through any external assistance but through its own unity. Air is a body of this type.

(3.1) All the things that are known to us or can become known are contained within the world. Some of them are parts of the world; some just have the status of matter. For all of nature needs matter, just as all the manual arts do. (2) I shall make this clearer: the eye, the hand, bones, and nerves are parts of us; the juice formed from recently eaten food, which will turn into parts, is matter. Then blood is a quasi-part of us, because <it is a part>, and yet it is also matter; for it renews the vital organs, and nevertheless it counts as one of the things from which our whole body is composed.

(4.1) In the same way air is a part of the world, and a necessary one. For it is what links heaven and earth, what separates the lowest and the highest levels and yet joins them: it separates them because it comes in between; it joins them because through it they can communicate with each other; whatever it receives from the earth, it passes upward, and, conversely, it spreads energy from the heavenly bodies over things on earth. (2) By quasi-part of the world, I mean,

for example, animals and trees; for the whole class of animals or trees is a part of the universe, because it is included in its totality, and the universe cannot exist without it; but a single animal or a single tree is a quasi-part, because even if it perishes, that from which it perishes remains a whole. Now air, as I was saying, coheres with both heaven and earth; it is naturally linked to each of them. Whatever is a natural part of anything possesses unity; for no natural organism lacks unity.

(5.1) Earth is both part and matter of the world. I do not think you will ask why it is a part, unless you also ask why the heavens are a part: because, of course, the universe cannot exist without the one any more than without the other, because the universe contains the things of which <it is composed. Then again, the earth is matter of the world,> since from it nourishment is apportioned to all the animals, all the plants, all the heavenly bodies; (2) from it provision is made for each thing individually and for the world itself with all its numerous demands; it produces nourishment for all those heavenly bodies, which are so energetic, so eager, by day and night, in both their activity and their feeding.[8] All things by nature seize enough for their own nourishment, and the world has appropriated as much as it needed for eternity. I shall offer you a tiny illustration of this important fact: eggs contain enough liquid to generate the creature that will emerge.

(6.1) Air is continuous with the earth and connected to it in such a way that it will immediately occupy any space from which the earth withdraws. It is a part of the whole world, but nevertheless it receives whatever the earth emits for the nourishment of the heavenly bodies, so that it should be reckoned as matter, not as a part. This is the cause of all its instability and turbulence.

(2) Some people form air from discrete particles,[9] like dust. They could not be further from the truth. For there can be no pressure except from a body bound together in unity, since the parts need to agree and combine their forces to produce tension. If air is chopped up into atoms, it is scattered; but dispersed things cannot be in tension. (3) The tension of air will be revealed to you by things that are inflated and do not give way when they are hit; it will be revealed by heavy objects transported a great distance as the wind carries them; it will be revealed by voices, which are faint or clear depending on how

the air is excited. For what is a voice but tension in the air produced by the tongue striking it so as to be audible? (4) What is running, and every form of motion? Are they not the activities of breath in tension? That gives strength to sinews and speed to runners. That, when it is violently agitated and whips itself up, tears up trees and woods, seizes whole buildings, and smashes them high in the air. That stirs up the sea, which is naturally sluggish and still. (5) Let us consider smaller-scale phenomena. What music is there without breath in tension? Horns and trumpets, and instruments that by water pressure make a louder sound than can be produced with the mouth,[10] do they not perform their function thanks to air in tension? Let us look at things that exert great force invisibly: tiny seeds, slim enough to fit in the crevices between stones, grow so big that they dislodge huge bits of masonry and destroy monuments; very small, very fine roots sometimes split rocks and cliffs. What else is this but breath in tension, without which nothing is strong, and against which nothing is strong? (6) One can infer that unity is characteristic of air just from the fact that our bodies hold together. What else could make them cohere, apart from breath? What else is there that moves our mind? What motion could it have except tension? What tension, except from unity? What unity, unless it existed in air? What else produces fruit, makes weak, green corn stand upright, and makes trees either spread their branches out or grow up high, apart from the tension and unity of breath?

(7.1) Some people tear air apart and divide it into particles,[11] mixing void with it. They think they have a proof that it is not a solid body, but contains a lot of vacuum, in the fact that birds can move so easily in it, and the largest and the smallest things can pass through it. (2) But they are wrong: movement in water is just as easy, and there is no doubt about its unity, for water makes way for bodies by constantly flowing backward in the opposite direction to the bodies for which it makes way. Our writers call this "closing-round"; the Greeks call it *antiperistasis*. This occurs in air just as in water; for it closes round every body by which it is displaced. So there will be no need for a mixture of void. But more of this another time.[12]

(8) There is no need to spend <a long time> proving that there are some violent, powerful things in nature. Now, nothing is very violent except as a result of tension, and equally, by Hercules, nothing will be

able to acquire tension from another thing unless something is in tension in itself; for, in the same way, we say that nothing can be moved by another thing unless there is something that can move of itself.[13] Now what has a more credible claim to possess tension in and of itself than breath? Who will deny that it has tension when he sees the earth and its mountains being shaken, along with buildings and walls, large cities with their populations, and seas with their entire coastlines?

(9.1) The tension of breath is demonstrated by its speed and expansion. The eyes instantly project their rays for many miles; a single shout reaches an entire city at once; light does not creep along gradually but spreads over everything at once. (2) Also, how could water be in tension except through breath? Do you doubt that the spray that rises up from the foundations in the middle of the arena and carries saffron scent right up to the highest level of the amphitheatre is produced by tension in the water? Yet neither the hand nor any other mechanism, but only breath, can push or propel the water: it puts itself at breath's disposal; it ascends as breath is introduced and compels it; it struggles repeatedly against its own nature and rises up, although by nature it flows down. (3) What? Do ships weighed down by cargo not demonstrate clearly that it is not water that prevents them from sinking, but breath? For water would give way and could not support heavy weights if it were not supported itself. A discus dropped from above onto a pool does not sink but bounces back up again: how, unless breath repels it? (4) How else are voices transmitted through the barrier of house walls except because air is present even in solids, picking up a sound produced outside and passing it on to the adjoining area? Obviously by means of breath it imparts tension not just to what is open, but to what is invisible and enclosed too; which is easy for it to do, because nowhere is it divided, but it unites with itself right through the middle of objects that seem to break it up. You may put walls and high mountains in the way, and it will be prevented from granting passage through all that to us, but not to itself. The only thing that is blocked is our route in pursuit of it; the air itself can go through the very thing that divides it, and it does not merely flow round the intrusion and encircle it on both sides, but passes right through it.[14]

(10.1) Air extends from the clearest part of the aether right down to the earth. It is nimbler, thinner, and higher than the earth, than

the waters too, but it is denser and heavier than the aether and is intrinsically cold and dark; its light and heat come from elsewhere. But it is not uniform throughout its whole extent; it is altered by what is closest to it. (2) Its highest region is very dry and hot, which makes it very rarefied too, because of the proximity of the eternal fires, all those heavenly bodies in motion, and the constant revolution of the heavens. Its lowest region, close to the earth, is dense and murky, because it receives the earth's exhalations. Its middle region, if you compare the highest and lowest parts, is more moderate in respect of dryness and rarefaction but colder than both the other regions. (3) For its upper levels feel the heat of the nearby heavenly bodies. Its lower levels are warm too: first from the earth's exhalation, which brings with it a lot of heat; then because the sun's rays are reflected back and gently warm the air with double the amount of heat as far as they are able to retrace their course. Another source of its heat is the warm breath that all animals, trees, and plants contain (for nothing could live without heat). (4) Then add the fires, not just those lit by human hand and plain to see, but the ones hidden by the earth; some of them have erupted, but countless others constantly blaze in unseen, hidden depths. All the fertile regions of the earth possess some warmth, since cold is sterile, but heat is productive. So the middle section of the air, remote from these influences, remains in its cold state; for air is cold by nature.

(11.1) Since the air has these divisions, in its lowest region it is particularly variable, restless, and changeable. Near the earth it often takes the initiative and is often passive; it suffers harassment, and it harasses. It is not all affected in the same way, but differently at different points, and it is unsettled and troubled only in parts. (2) The causes of its changeability and restlessness derive, some of them, from the earth, whose positions, facing in this direction or that, have great influence on the condition of the air. Other causes derive from the motions of the heavenly bodies. You should assign the leading role among them to the sun: it guides the year; its turning causes the cycle of winters and summers.[15] Next most influential is the moon; but the other stars too influence things on earth no less than the breath that lies close to the earth; and by their motion, or by their countermotion,[16] they confusedly cause sometimes cold, sometimes rain and other harsh conditions on the earth.

(3) It was necessary to say all this by way of preface before speaking about thunder, lightning-bolts, and lightning-flashes.[17] For since they occur in the air, a description of its nature was needed to make it more readily apparent what it could do or have done to it.

(12.1) There are three phenomena: lightning-flashes, lightning-bolts, and thunder, which is produced at the same time but heard later. A lightning-flash displays fire, a lightning-bolt ejects it: the first is, so to speak, a threat and an attempt that fails to strike home; the other is a throw that does strike home. (2) There are some points on which everybody is agreed, some on which there are different opinions. It is agreed that all these phenomena are produced in clouds and from clouds; it is additionally agreed that both lightning-flashes and lightning-bolts either consist of fire or look like fire. (3) Let us now pass on to the contested points: some people think that fire is present in the clouds; some think that it is produced for the occasion and is not present before it is emitted. Those who produce the fire beforehand cannot agree among themselves either, for they gather it together from different sources. Some say that the sun's rays run backward and forward, criss-crossing repeatedly, and set the fire alight. Anaxagoras says that it trickles down from the aether;[18] from the immense heat of the heavens, many particles fall down, get trapped in clouds, and are preserved there for a long time. (4) Aristotle does not think that the fire is gathered long beforehand,[19] but thinks it leaps out at the same moment as it is produced. His view is as follows: "Two parts of the world lie at its lowest point, earth and water. Each emits something: the vapor coming from earth is dry and smokelike, producing winds, lightning-bolts and thunder; water's exhalation is moist and turns into rain and snow. (5) But that dry vapor coming from earth, which is the source of winds, once it is massed together, gets squeezed out by the clashing of clouds in violent motion; then, with this powerful propulsion, it will strike adjacent clouds. The impact of the blow is accompanied by a noise like the one produced in our fires when a flame crackles because the firewood is too green; for there too breath that contains some moisture and is massed together is exploded by the flame. In the same way the breath, which I said a moment ago is forced out by colliding clouds, when it is driven against other clouds, can be neither <extinguished nor> exploded in silence. (6) The noises are varied because the clouds

are varied, some having a larger hollow, others a smaller one. Now, the powerful mass of breath that is ejected is fire, and it is called a lightning-flash; it is set ablaze by a slight impact, and is feeble. We see the flash before we hear the sound because our eyesight is swifter and runs way ahead of our hearing."

(13.1) The view of those who store fire in the clouds is wrong, as many arguments can demonstrate. If fire falls down from the heavens, why does it not happen every day, since the heat is always constant up there? Then they have not given any reason why fire, which nature summons upward, should flow down. For the situation is quite different with our fires, from which sparks do fall down; they possess a certain amount of weight, and so the fire does not descend but is plunged and pulled down. (2) Nothing like this will happen in that completely pure fire in which there is nothing to be propelled downward; or if any part of it does fall down, the whole of it is endangered, because anything that can lose bits can all fall down. Then is what falls light or heavy? Is it light? Then it cannot tumble down: anything prevented from falling by lightness will maintain its elevated position. Is it heavy? How could it ever be in a place from which it was possible to fall? (3) "Tell me, then, are not some fires regularly brought down to a lower level, such as the very things we are investigating, lightning-bolts?" I agree. However, they do not go, they are carried; some force pushes them down, and that is not in the aether, where there is no unjust coercion, no disruption, nothing abnormal. (4) Everything is ordered, and the purified fire, which has been assigned the highest place in the protection of the world, encircles the outer edge of this quite beautiful structure. It cannot descend from there, but neither can it be compelled by anything outside itself, because in the aether there is no room for any unstable body, and stable, ordered things do not do battle.

(14.1) "All of you, I declare, when you are explaining the causes of shooting stars, say that certain sections of the air can attract fire from the heat of the higher region and thus be set ablaze." But it makes a great difference whether someone says that fire falls downward from the aether, which nature does not permit, or says that heat jumps across from that powerful fire to the regions below. For the fire does not fall from up there, which is impossible, but it is started down here. (2) Certainly in our own experience, when a fire spreads far and

wide, we see some blocks of houses heat up over a long period and then catch fire spontaneously; so it is likely that, in the highest level of the air as well, something capable of catching fire is set ablaze by the heat of the aether above it. For it must be the case both that the lowest level of the aether contains something like air, and that the highest level of the air is not unlike the lowest level of the aether, since the transition between the two different things is not instantaneous. At the boundary they gradually blend their properties, so that you could be unsure whether it is still air or already aether.

(15) Some of our people think that air, because it can change into fire and water, does not attract some new source of flame from elsewhere: for it sets itself alight by its motion, and when it shatters clouds that have dense, compacted hollows, it inevitably produces an enormous noise as such large bodies are torn apart. This battle, as the clouds reluctantly surrender, contributes to the fire's being set ablaze, in the same way as a hand contributes to a blade's cutting, but cutting is the function of the blade.

(16) What is the difference between a lightning-flash and a lightning-bolt? I shall explain: a lightning-flash is fire spread far and wide; a lightning-bolt is concentrated fire ejected vigorously. We sometimes hold water in our two cupped hands, then force it out, as if from a pump, by pressing our palms together. Imagine that something similar happens up there too: the narrow gap between two clouds that are pressed together ejects the breath in between, and in the process sets it alight and hurls it like a catapult. For ballistas and scorpions also make a noise as they fire their weapons.[20]

(17) Some people think that fiery breath moving through cold and moisture generates the noise. For red-hot iron is not silent either when it is plunged in liquid: if a glowing lump is lowered into water, it is extinguished with a loud noise.

According to Anaximenes,[21] breath colliding with clouds produces thunder, and as it struggles to get through the obstacles in its way and tears them apart, in the process of escaping it ignites the fire.

(18) Anaximander referred all <these> phenomena to breath:[22] "Thunder," he said, "is the sound of a cloud being struck." Why is it uneven? Because the <breath> is too. Why does thunder also occur in a clear sky? Because then as well breath leaps forth through dense, torn air. Yet why is there sometimes no lightning-flash, but there is

thunder? Because weaker breath was not strong enough to produce a flame but was strong enough to produce a noise. So what exactly is a lightning-flash? Turbulence caused by air spreading out and rushing together again,[23] revealing a weak fire that will not escape. What is a lightning-bolt? The rapid motion of more violent, denser breath.

(19) Anaxander says that all these phenomena are produced by energy descending from the aether to lower levels:[24] thus fire strikes cold clouds with a noise. When it tears them apart, there is a flash, and fire with lower energy produces lightning-flashes; with higher energy, lightning-bolts.

(20.1) Diogenes of Apollonia says that some thunder is produced by fire,[25] some by breath: fire produces the thunder that it itself precedes and announces; breath produces the form that crashes without any flash. (2) I admit that each can sometimes be effective without the other, with the proviso that their properties are not completely distinct, but each can be produced by the other. For who will deny that breath propelled with great force, when it has generated a noise, will also generate fire? Who will not also admit that sometimes fire too can burst into a cloud but fail to escape, if it has torn through a few clouds, but is overwhelmed by a conglomeration of many of them? So fire can turn to breath and lose its brightness, and also breath can ignite air as it slices through it. (3) Add that the impetus of a lightning-bolt, since it has crashed into the air with such a huge impact, must both send breath on ahead, driving it forward, and pull a wind along behind; and so everything trembles before it is struck, shaken by the wind that the fire has pushed along in front of it.

(21.1) Now we dismiss our teachers and start to proceed independently, and from agreed points we pass on to uncertain ones. What is agreed? That a lightning-bolt is fire, and so is a lightning-flash, being nothing other than a flame that would have been a lightning-bolt if it had had more power; they differ not in their nature but in their force. (2) That they are fire is demonstrated by their color, which is not produced by anything else. Their effects demonstrate this too: for often lightning-bolts cause great conflagrations; forests have been burned down by them, and city districts; even things that have not been struck by them can be seen to have been burnt, and some things are blackened with soot, as it were. Then think of how everything struck by lightning smells of sulphur. (3) So it is agreed

that both phenomena are fire, and both differ in their motion and their location: for a lightning-flash is a lightning-bolt that has not traveled right down to earth, and, conversely, you might say that a lightning-bolt is a lightning-flash that has been brought right down to the earth. (4) I am not going over the same point at great length for the sake of verbal gymnastics, but to prove that these things are related and of the same kind and nature. A lightning-flash is almost a lightning-bolt. Let us turn that around: a lightning-bolt is something more than a lightning-flash.

(22.1) Since it is agreed that both of them are fire, let us see how fire is generally produced at our level; for it will be produced in the same way higher up as well. <It is produced> in two ways: one, if it is lit by <striking>, as from a stone; the other, if it is elicited by friction, as when two sticks are rubbed together for a long time. (Not every type of wood will achieve this for you, only types suitable for extracting fire, such as laurel, ivy, and others familiar to herdsmen for this purpose.) (2) So it can happen that clouds as well produce fire in the same way when either struck or rubbed. Let us consider with what force storms rage, with what energy whirlwinds rotate: anything in their way is shattered, and seized, and thrown far from its starting point. (3) So is it remarkable if such great energy forces <fire> out of something else or out of itself? For you see how much heat will be felt by bodies that undergo friction as those winds pass by. And you should not imagine that this occurs only in the case of things whose immense power is generally acknowledged: **(23.1)** perhaps clouds as well, when driven into another cloud by a wind that pushes and gently persists, will elicit a fire that shines out but does not leap out; for less energy is required to produce a lightning-flash than to produce a lightning-bolt. (2) Above, we showed how hot some things become through friction. Now then, since air can change into fire, and it is subjected to a very powerful frictional force (namely, its own) when it turns into wind, it is likely that fire is emitted; but the fire is temporary and bound to die down quickly, since it is not starting in solid material or material in which it can become established. So it is transient, and its duration is only as long as its journey and its course; it has been ejected without fuel.

(24.1) "How is it," someone asks, "that, although you say it is the nature of fire to head for higher levels, the lightning-bolt heads for

the earth? Either <that is untrue or> what you said about fire is untrue, for it can travel up or down equally well." Both statements can be true. For fire by nature rises to a point,[26] and if nothing prevents it, it ascends; just as water by nature moves downward, but if some force is applied to turn it in the opposite direction, it is directed toward the place from which it fell as rain. (2) A lightning-bolt <is flung downward> by the same overwhelming force by which it is ejected. What happens to these fires is what happens to trees whose tops can be pulled down till they point to the ground, even, if they are supple, till they touch it; but when you let go, they will spring back to their original position. So you should not focus on a state that is contrary to the inclination of the thing in question. (3) If you allow fire to go where it wants, it will head for the heavens, the home of all the lightest things; when there is something that collides with it and diverts it from its instinctive motion, then not nature but slavery has issued the orders.

(25) "You tell us," someone says, "that clouds emit fire when they rub against one another, even though they are moist, or, better, sodden. So how can they generate fire, which is no more likely <to be produced> from a cloud than from the water <which> originates from the cloud?" **(26.1)** First, clouds do not contain water, but air that is dense and ready to generate water; it has not yet turned into it but is already inclined and tending that way. You should not think that the water first collects and then pours down; it is produced and falls at the same moment. (2) Then, if I grant that clouds *are* moist and full of ready-formed water, all the same, nothing will prevent fire being given off from something moist, and indeed, what you will find more surprising, from moisture itself. Some people have maintained that nothing can change into fire without first changing into water; so a cloud can emit fire from some part of it while preserving the water it contains, just as often one part of a piece of wood is burning while another is sweating. (3) I am not saying that these things are not opposed to each other and are not eliminated by each other, but when fire is more powerful than moisture, it wins; and, conversely, when the amount of moisture is greater, then the fire is ineffective; and so green wood does not burn. It depends on how much water a thing contains; for a tiny amount will not impede or stop the force of the fire. (4) Of course not. Within our ancestors' memory, as Posidonius records,[27]

when an island was rising up in the Aegean sea, during the daytime the sea foamed, and smoke rose up from the depths, but it was only nighttime that revealed the fire. This was not continuous, but flashed at intervals, like lightning-bolts, whenever the subterranean heat had overcome the weight of water that lay above it. (5) Then stones and rocks were hurled out, some of them intact, expelled by breath before they were burnt, some of them eaten away and rendered as light as pumice. Finally the tip of a burnt mountain emerged; afterward its height increased, and the rock grew to the size of an island. (6) The same happened within our memory in the second consulship of Valerius Asiaticus.[28] Why have I mentioned all this? To make it clear that the fire was not extinguished by the sea that covered it, and its force was not prevented from escaping by the weight of a great volume of water. Asclepiodotus,[29] the student of Posidonius, records that the depth from which the fire ripped through the waters and emerged was two hundred feet. (7) Now, if the enormous force of the water could not stifle the force of the flames rising from the sea-bed, how much less will the fine, dewy moisture of clouds be able to stop a fire? Far from slowing it down, it is actually one cause of the fire, which we do not see flashing except from an overcast sky. A clear sky is free from lightning-bolts; a cloudless day does not harbor those terrors, nor does nighttime except when darkened by clouds. (8) "Tell me, then, does not lightning sometimes occur even when the stars are visible and the night is peaceful?" However, you may be sure that there are clouds in the region from which the flash comes, but the curvature of the earth prevents us from seeing them. (9) Add that it is possible that low clouds close to the ground undergo friction and emit fire, which is forced higher up and appears in a region of the sky that is clear and cloud-free, although it is produced in a cloudy region.

(27.1) Some people have distinguished different kinds of thunder, saying that there is one with a deep rumble, such as precedes an earthquake when a wind is trapped and roars. I shall explain how they believe it is formed. (2) When clouds have trapped breath inside themselves, the air eddies within their hollows and makes a noise like bellowing; it is hoarse, steady, and continuous, at least when the region is moist and prevents any escape, and so this kind of thunder is a sign that rain is on the way. (3) Another kind of thunder is

harsh and sharp—I should call it a crack rather than a noise—such as we are used to hearing, for example, when a bladder is burst over someone's head.[30] This kind of thunder is emitted when a cloud has accumulated and is shattered, driving out the breath with which it had been inflated. This can properly[31] be called a crash, sudden and powerful. Its occurrence makes people collapse and die; some live in a daze and completely lose their senses—we call them thunderstruck, when that noise from the heavens has deranged their minds. (4) It can also be produced when air is shut in a hollow cloud, is rarefied by its motion, and expands; then while it tries to find more space for itself, it endures a noise caused by the things that envelop it. And anyway, just as hands struck together produce a clap, can a noise not come from clouds as they collide together, a big noise, because big objects are clashing?

(28.1) "We see clouds striking a mountain," someone says, "but no noise being produced." First of all, they do not produce a noise irrespective of how they collide, but only if their structure is well-suited to emitting one. Strike the backs of your hands together and they will not produce a clap, but palm meeting palm will do so; and it makes a great deal of difference whether they are slightly cupped as they are struck together, or flat, or extended. Then, the clouds must not just be moving, but must be propelled by a powerful, stormy force. (2) Then again, a mountain does not split a cloud but divides it, separating it one bit at a time. Even a bladder does not make a noise irrespective of how it ejects the breath: if it is sliced with a knife, it escapes without making any impression on the ears; it must be burst, not cut, to make a noise. I maintain the same about clouds: unless they have shattered in a powerful impact, they do not make a noise. Add that clouds driven against a mountain do not burst but pour round it, and they strike some parts of the mountain before the mountain itself; they envelop trees, branches, bushes, and sharp, projecting rocks in such a manner that if they contain any breath, they emit it at many different points. But unless it all bursts out at once, it does not produce a crash. (3) So that you can be certain of this, a wind that divides around a tree whispers but does not thunder. A broad impact, so to speak, one that disperses the whole mass in a moment, is required for a noise to erupt such as is heard when there is thunder.

(29) In addition, air is naturally suited to sounds. Obviously enough, since a sound is just air that is struck. Therefore clouds that are both hollow and tensed need to be pushed against each other. You see how hollow objects are much more resonant than solid ones, and things in tension much more than things that are slack. That is how drums and cymbals make a noise, because the former set up a vibration in the resistant breath inside them, and the latter only ring when the bronze is concave.

(30.1) Some people, including Asclepiodotus, think that thunder and lightning-bolts can be emitted by the clash of dry bodies as well. Etna once overflowed with a large quantity of fire and poured out an enormous mass of burning sand; daylight was shrouded in dust, and the sudden darkness terrified whole peoples. On that occasion, they say, there were then numerous lightning-bolts and thunderclaps, which were produced by the clash of dry bodies, not of clouds, which are unlikely to have been present when the air was so hot. (2) Once Cambyses sent an army to Ammon,[32] and sand, whipped up by a south wind and falling like thick snow, covered it and then buried it. It is likely that on that occasion too thunder and lightning-bolts were produced by the friction of sand against sand. (3) This view does not contradict our own assumptions: for we have said that the earth gives off particles of both kinds,[33] that both dryness and moisture are milling around throughout the atmosphere. So if something like that is involved, it forms a solider, denser cloud than if it were constructed just from pure breath, (4) and that cloud can burst and emit a noise. The phenomena I have mentioned, whether they fill the air with burning fires or with winds that scour the earth, must make a cloud before they make a noise. Clouds can be formed by dry materials just as by moist ones; for, as we have said,[34] a cloud is a concentrated mass of dense air.

(31.1) The effects of a lightning-bolt, should you wish to examine them, are amazing and leave no doubt that its power is divine and subtle. Silver coins are melted together inside boxes that remain intact and unharmed. Sheaths are unaffected, while their swords are melted, and the entire metal head trickles down a spear while its wooden shaft remains undamaged. Wine stands rigid after the wine-jar is broken, but its solidity lasts for no more than three days.[35]

(2) Among the remarkable effects you can also include the fact that, when humans and other animals are struck, their heads face toward the exit point of the lightning-bolt,[36] and that when trees have been struck, splinters always fly up on the opposite side to the lightning-bolt. Then what do you make of the fact that, when dangerous snakes and other animals with deadly secretions are struck by a lightning-bolt, all the poison is consumed? "How do you know?" someone asks. Worms are not produced in bodies that contain poison;[37] but when they have been struck by a lightning-bolt, they produce worms within a few days.

(32.1) What do you make of the fact that lightning-bolts indicate the future, and do not give signs of just one or two events, but often predict a long, connected series of fated events, and do so with plain indications, much clearer than if they were written down?[38] (2) There is this difference between us and the Etruscans, who have the greatest expertise in the investigation of lightning-flashes: we think that lightning-bolts are emitted because clouds collide;[39] they think that clouds collide in order that lightning-bolts may be emitted. For since they ascribe everything to god, they are of the opinion that they do not indicate the future because they have occurred, but they occur because they are intended to indicate the future. But they occur in the same manner whether indicating the future is their purpose or just a consequence. (3) "So how do they indicate the future if they are not sent for that very purpose?" Just as birds do not move in order to be seen by us, yet they produce favorable or unfavorable auspices. "They too are set in motion by god," someone objects. But you make him into somebody with too much time on his hands, a servant performing a very trivial task, if he arranges omens for some people and entrails for others.[40] (4) They are just as much the results of divine agency if birds' wings are not guided by god, and the entrails of cattle are not formed under the very axe. The sequence of fated events unfolds in a different way, sending out signs of the future at every point, some of them familiar to us, some unknown. Everything that happens is a sign of some future event. Chance events and purposeless, chaotic ones do not admit of divination; where there is order, there is also predictive force. (5) "So why is the eagle granted the honor of giving auspices of important events, or the raven and a tiny number of other birds, while the voices of the rest lack prophetic power?"

Because some things have not yet been incorporated into the system, and some never could be, because our acquaintance with them is too remote. However, there is no living creature that does not foretell something by its movement and by an encounter with us. But, to be sure, not everything gets noticed.

(6) An auspice belongs to an observer, and so it relates to the person who has paid attention to it.[41] But even the ones that go to waste do occur. (7) The observations of the Chaldaeans have recognized the influence of the five stars.[42] Well, do you think that all those thousands of heavenly bodies shine without any job to do? What else leads the experts on horoscopes into most serious error but the fact that they assign control over us to just a few stars, although all the stars overhead claim a share of us for themselves? Perhaps the lower ones exert their influence on us from closer quarters, and they move more frequently, and keep changing the aspect with which they look at us.[43] (8) But even those that either *are* motionless or *look* motionless because their speed is comparable to that of the universe are not excluded from rights and control over us. They regard us from different aspects and share round the responsibilities as they carry on their business. It is not easy to know what they are capable of, but equally it should not be doubted that they are capable of something.

(33) Now let us return to lightning-bolts. The system is divided into these three areas: how we inspect them, how we interpret them, how we expiate them. The first part concerns the type;[44] the second, divination; the third, propitiation of the gods. One must pray to them when there is a good lightning-flash and ask them for mercy when there is a bad one: pray that they would confirm what is promised, ask for mercy so that they will withdraw their threats.

(34.1) They regard the lightning-bolt as the most powerful, because whatever is foretold by other things is annulled by the intervention of a lightning-bolt; and whatever it foretells is fixed, and not altered by the meaning of another portent. Whatever threats are issued by entrails or birds will be canceled by a favorable lightning-bolt; whatever is announced by a lightning-bolt is not proved wrong either by entrails or by a bird that contradicts it. (2) On this point they seem to me to be mistaken. Why? Because nothing is more true than truth. If birds have sung about the future, this auspice cannot be invalidated by a lightning-bolt; otherwise it was not the future that

they sang about. For I am not now comparing a bird and a lightning-bolt, but two signs of the truth, which, if they indicate the truth, are of equal standing. So if the intervention of a lightning-bolt annuls any indications from entrails or augury, then the entrails were not properly examined, or the auguries were not properly observed. It makes no difference which thing has the grander appearance or the more powerful nature; if they both give indications of the truth, in this respect they are of equal standing. (3) If you should say that flame is more powerful than smoke, you will not be mistaken; but as indications of fire, flame and smoke are equally significant. So if they are saying, "Whenever entrails indicate one thing, and lightning-bolts another, the lightning-bolts will have greater authority," perhaps I shall agree. If they are saying, "Although one of them had predicted the truth, the strike of the lightning-bolt did away with the previous signs and won acceptance for itself," that is false. Why? Because it does not matter how many auspices there are: there is only one fate, and if that is properly understood from the first auspice, it is not annulled by the second. (4) This is what I am saying: it does not matter if we are searching for something by a different means, because what we are searching for is the same. Fate cannot be altered by a lightning-bolt. Of course not, for the lightning-bolt is itself a part of fate.

(35.1) "Well then, what is the point of expiations and purificatory sacrifices if the fates are immutable?" Allow me to speak for that severe sect of people who greet all these things <with derision>, and regard them as nothing but consolation for a troubled mind. (2) The fates pursue their rights in a quite different manner: they are not moved by any prayers; they cannot be swayed by pity, or by favoritism; they have started an irreversible course and surge ahead according to plan. Just as the water in rapid torrents does not run back on itself and does not even pause, because what comes along behind propels what is in front, so the eternal chain of events makes the course of fate roll onward; and its first law is this: to abide by what is decreed.

(36) For what do you understand by fate? I regard it as a necessity governing all events and all actions, which no force can disrupt. If you think it can be placated by sacrifices or by the life of a snow-white lamb, you do not know the divine. All of you say that even a wise

man cannot change his mind; that is much more true of god, since a wise man knows what is best at the present moment, but everything is present to god's divine nature!

(37.1) Now I want to present the case for those who think that purificatory sacrifices should be used against lightning-bolts and who have no doubts that expiation is effective, sometimes for the prevention of dangers, sometimes for their reduction, sometimes for their postponement. (2) I shall pursue the consequences of this view shortly. For the moment, they have this in common with us, that we also think that vows are beneficial, without any infringement of the power and influence of fate. For some things are left undetermined by the immortal gods, so that they can have a good outcome if prayers are offered to the gods, or if vows are undertaken; so this is not contrary to fate, but is itself contained within fate.

(3) "Either it's going to happen or it's not," someone says. "If it's going to happen, it will happen, even if you do not undertake vows. If it's not going to happen, even if you do undertake vows, it will not happen." Your dilemma is invalid, because you are ignoring the proviso that falls between those alternatives: this will happen, but only if vows are undertaken.

(38.1) "But," someone says, "fate must also cover this very point, that you either undertake vows or you do not." Regard me as surrendering to you and conceding that the fact that vows will occur is also covered by fate: therefore they will occur. (2) It is fated that one man should be eloquent, but only if he learns to read; the same fate includes the point that he should learn to read: therefore he must be taught.[45] This man will be wealthy, but only if he goes to sea; but in the sequence of fated events that promises him a large fortune, this too is necessarily included, that he should also go to sea: therefore he will go to sea. It is the same with expiations, I tell you: someone will escape the dangers if he expiates the divinely predicted threats; but it is also fated that he should expiate them; therefore he does expiate them. (3) Such arguments are commonly used against us to prove that nothing is left to our will, and that full rights over our actions are handed over <to fate>. When I am dealing with that topic, I shall explain how something is left to the individual's decision, though fate remains intact. But for the present I have explained what is under discussion, how, if the course of fate is fixed, expiations and

placatory sacrifices can avert the dangers of prodigies: the reason being that they do not compete with fate, but they themselves are subject to fate's law. (4) "So what use is a diviner to me?" you ask. "For it is necessary for me to perform the expiation in any case, even if he does not advise it." He is of use because he is a servant of fate; in the same way, although we are indebted to fate for good health, we are also indebted to the doctor, because fate's kindness reaches us through his hands.

(39.1) Caecina says that there are three kinds of lightning-flashes,[46] advisory, authoritative, and what is called situational.[47] The advisory kind occurs before action but after deliberation, when people are considering some action and are either advised to do it or advised against it by the stroke of a lightning-bolt. The authoritative kind comes after an action, and indicates that it will turn out for good or bad. (2) The situational kind occurs when a lightning-bolt intervenes while people are resting, not doing anything, and not even considering any action; it delivers a threat, or a promise, or a warning. He calls this the warning kind, but I do not see why it is not the same as the advisory kind; for someone who gives a warning gives advice too. (3) But let us grant that there is a difference, and let us distinguish the warning kind from the advisory, because the latter advises both for and against actions, whereas the former covers only the avoidance of imminent danger (as when we fear fire, deception by those nearest to us, or a treacherous attack <by ***>[48] or by slaves). (4) What is more, I can see a further difference between them too: the advisory kind occurs when one is considering some action; the warning kind when one is not considering any. Each kind has its own distinct character: advice is given to those who are deliberating, but people receive warnings out of the blue.

(40.1) Now in the first place these are not types of lightning-bolt, but types of meaning. For the types of lightning-bolt are as follows: the one that drills, that shatters, and that burns. The type that drills is fine and flamelike, and escapes by a very narrow route on account of the untainted, pure thinness of the flame. (2) The type that shatters is concentrated, and a lot of dense, stormy breath is mixed in with it. And so the first type of lightning-bolt returns and escapes through the same aperture by which it entered when the blow struck; the second has widely dispersed energy that breaks up what it hits and

does not bore through it. (3) The third kind, which burns, contains a lot of earthy matter and is fiery rather than flamelike; and so it leaves behind extensive signs of the fire, and they remain in the stricken objects. Of course no lightning-bolt occurs without fire, but all the same we call this kind fiery in a strict sense because it imprints clear traces of heat, because it either burns or blackens. (4) It burns in three ways: either it singes and causes only slight damage, or it burns up, or it sets ablaze. These all involve burning, but of different kinds and degrees: whatever is burned up is also necessarily burned, but what is burned is not necessarily burned up; (5) likewise what is set ablaze <is necessarily burned as well, but what is burned is not necessarily set ablaze>: for fire may have burned it as it passed through. Who does not realize that some things are burned without being on fire, but nothing is on fire without being burned as well? I shall add one more point: something can be burned up but not set ablaze and can be set ablaze but not burned up. (6) Now I move on to the type of lightning-bolt that blackens what it strikes. This either discolors or colors. I shall explain what is distinctive about each: a thing is discolored when its color is spoilt, not changed; it is colored when its appearance becomes different from what it was, for instance, blue or black or pale.

(41.1) Up to this point the Etruscans and the philosophers share the same ideas, but they differ when they think that lightning-bolts are sent by Jupiter, and they give him three *manubiae*.[49] The first one, according to them, gives advice and is gentle, and is sent on the decision of Jupiter himself. The second one is sent by Jupiter, but on the advice of his council: for he summons the twelve gods.[50] This kind of lightning-bolt sometimes does some good, but not without doing harm at the same time; even its benefits come at a price. (2) The third *manubia* is sent by Jupiter again, but after he has summoned to his council the gods they call higher and hidden,[51] because it destroys what it strikes and invariably changes the private or public situation that it encounters. For fire allows nothing to remain as it was.

(42.1) Here, should you wish to examine the matter, antiquity at first sight seems to be mistaken. For what is so ignorant as the belief that Jupiter sends lightning-bolts from the clouds, aims at columns, trees, sometimes his own statues, and strikes harmless cattle, while leaving temple-robbers, assassins, and arsonists unpunished? that

Jupiter summons gods to his council, as though his own judgment were not good enough? that the lightning-bolts that he shoots on his own are favorable and gentle, but those whose firing is attended by a larger crowd of divinities are harmful? (2) If you ask me for my own view, I do not think that they were so stupid as to believe that Jupiter's choices were unfair or that his aim was not very good. When he hurled fires that struck the innocent and passed by the wicked, did he have no wish to throw them more justly, or did he not succeed in doing so? (3) So what was their purpose when they said this? In order to control the minds of the ignorant, those very wise men pointed to an inescapable object of fear. In order that we should be afraid of something superior to us, it was expedient, in the face of such audacious wickedness, for something to exist that nobody thought himself powerful enough to oppose; and so, to strike terror into those for whom innocence has no attraction unless fear is the driving force, they placed overhead an avenger, and one who was armed.

(43.1) So why is the lightning-bolt that Jupiter sends on his own a gentle one, and the one that he has consulted about and sent on the advice of the other gods a harmful one? Because Jupiter, that is the king, must help people even on his own, but must harm only when others share the decision. (2) Let all those who have acquired great power within human society learn that even a lightning-bolt is not sent without taking advice. Let them call a meeting, consider the opinions of many, restrain those who are inclined to do harm; let them keep this in mind, that when something needs to be struck down, not even Jupiter can rely just on his own judgment.

(44.1) And another point: they were not so ignorant as to think that Jupiter changes his weapons. It suits poetic license to say:

> There is another less heavy lightning-bolt, to which the
> Cyclops' right arm
> has added less savagery and flame, less anger;
> the gods call them the second-rank weapons.[52]

(2) But those most eminent men were not guilty of the error of thinking that Jupiter sometimes uses <heavier, sometimes> lighter lightning-bolts, like weapons used for training. But they wanted to warn those who have to hurl lightning-bolts against human wrong-doings

that they should not all be struck in the same way: some should be grazed, some shot down and shattered, some given a warning.

(45.1) Nor did they believe that Jupiter throws lightning-bolts with his hand, like the one we worship on the Capitol and in other temples.[53] They recognize the same Jupiter as we do, the ruler and guardian of the universe, the mind and breath of the world, the master and the craftsman of this creation, for whom every name will be appropriate.[54] (2) Do you want to call him fate? You will not be mistaken: he it is on whom everything depends, the cause of causes. Do you want to call him providence? You will be right: he it is by whose deliberation provision is made for this world, so that it can advance unhindered and unfold its actions. (3) Do you want to call him nature? You will not be wrong: he it is from whom everything is born, by whose breath we live. Do you want to call him the world? You are not mistaken: for he himself is all this that you see, contained in his own parts, sustaining both himself and his creation. The Etruscans too believed the same, and they said that lightning-bolts are thrown by Jupiter because nothing happens without him.

(46) "But why does Jupiter either pass by things that deserve to be struck, or strike harmless things?" You are summoning me to a wider inquiry, which must be allocated its own date, its own place. In the meantime I say this, that lightning-bolts are not thrown by Jupiter, but everything has been so arranged that even things that are not done by him do not happen without reason; and that comes from him. For even if Jupiter is not doing those things now, Jupiter ensured that they would be done. He does not handle individual things, but he has given everything its power and its cause.

(47) I do not agree with them about the following classification: they say that lightning-bolts are either perpetual, or limited, or extendable. They are perpetual when their significance applies to a whole life and does not announce one event, but embraces a combination of events that will occur from that moment on throughout the person's entire lifetime; these are the lightning-bolts that occur immediately after an inheritance has been received, or when a person or city faces a new situation. The limited ones always present themselves on a particular day. The extendable ones can have their threats deferred but not averted and eliminated.

(48.1) I shall explain why I do not agree with this classification. The lightning-bolt they call perpetual is also limited (for it equally presents itself on a particular day and is not any the less limited just because it signifies many events), and what they think is extendable is limited (for on their own admission there is a fixed maximum length to the deferral that can be granted: they say that private lightning-bolts cannot be deferred beyond ten years, public ones not beyond thirty years; which means they also are limited, because there is a cut-off point beyond which they cannot be extended). So every lightning-bolt and every outcome has an appointed day; for what is uncertain cannot be grasped.

(2) They describe the things to look for in lightning-flashes in a disorganized, rambling fashion, although they could classify them as they were classified by Attalus the philosopher,[55] who had devoted himself to this discipline. Then they would look for where it occurred; when; for whom; what he was doing; what type and what size it was. If I want to go into all the ramifications of this subject, then what shall I do? I shall be embarking on an endless task.

(49.1) Now I shall quickly sketch the categories of lightning-flash proposed by Caecina and shall explain what I think of them. He says there are postulatory ones, by which sacrifices that were interrupted or not correctly performed are demanded afresh; monitory ones, which tell one what to guard against; pestilential ones, which foretell death and exile; fallacious ones, which bring harm under the guise of some good (they bestow a consulship that will turn out badly for the holder or an inheritance whose profits must be paid for with some great loss); pronged ones,[56] which announce the appearance of danger without the substance; (2) annulling ones, which remove the threats of earlier lightning-bolts; attesting ones, which agree with earlier ones; *** [57] ones, which occur in an enclosed space; buried ones, which hit things that have been struck before but not expiated; royal ones, when the marketplace or the assembly place is affected, or the most important locations in a free city—they indicate that the state is threatened with monarchy; (3) infernal ones, when the fire has sprung out of the earth; hospitable ones, which summon Jupiter to us by means of sacrifice and[58], to use their milder word, invite him (but he would not grow angry if he were invited: as it is they declare that his arrival brings great danger to the people consulting him); and

helpful ones, which come in response to an appeal, but to the benefit of those calling on them.

(50.1) How much simpler is the classification used by our Attalus, a splendid man, who had combined the learning of the Etruscans with Greek acuteness. There are some lightning-bolts that indicate something that concerns us, <some that indicate what does not concern us,> and some indicate either nothing, or something of which we have no understanding. (2) Of those that indicate something, some are favorable, some hostile, <some mixed,> some neither hostile nor favorable. The categories of hostile ones are as follows: they foretell harm that is either unavoidable, or avoidable, or capable of reduction, or of deferment. Favorable ones indicate either lasting or transient circumstances. (3) Mixed ones either contain partly good, partly bad, or they change bad to good or good to bad. They are neither hostile nor favorable if they indicate to us some action that should neither frighten nor delight us, or a journey involving no element of fear or hope. **(51)** I return to the lightning-bolts that indicate something, but it is of no concern to us; for example, that the same lightning-bolt as has already occurred will occur again in the same year for the same person. Nothing, or something that eludes our knowledge, is indicated, for instance, by the ones that are showered on the immense sea or on empty wildernesses; their meaning is either nonexistent or lost.

(52.1) I shall add a few more illustrations of the power of the lightning-bolt, which does not cause the same sort of damage in every material. It shatters stronger things very violently, because they resist, but it sometimes passes harmlessly through things that yield. It clashes with stone, iron, and the hardest objects, because it must find a way through them by force; and so it forges an escape route. But it spares soft and less dense things, even if they seem readily inflammable, because it is given an easy passage, and its arrival is gentler. And so, as I have said,[59] boxes remain intact, while the money that was in them is found fused together, because the very fine fire passes through hidden passageways, but it conquers anything solid and obstinate that it finds inside the wood. (2) It does not rampage in only one way, as I have said,[60] but you will deduce what its violence has achieved in each instance from the precise nature of the damage, and you will recognize the lightning-bolt from its effect.

Sometimes the violence of one and the same lightning-bolt produces many different effects in the same material. For example, in a tree it burns the driest parts; it drills through and shatters the hardest and densest parts; it scatters the outer bark; it bursts and tears the inner bark; and it perforates and strips off the leaves. It freezes wine and melts iron and copper.

(53.1) It is remarkable that wine that has been frozen by a lightning-bolt,[61] when it returns to its previous state, either kills people or drives them mad if they drink it. As I am wondering why this happens, the following occurs to me: there is a deadly power in the lightning-bolt; it is plausible that some breath from it remains in the liquid that it has congealed and frozen, for it could not have been solidified without some kind of binding-agent being added to it. (2) Besides, olive oil and perfumes of every sort have a foul smell after a lightning-bolt, from which it is clear that this very subtle fire, driven along contrary to its own nature, contains a deadly force that not only destroys what it strikes but <spoils> what it scorches. Besides, it is well established that, wherever a lightning-bolt falls, the smell of sulphur is found; being oppressive by nature, if inhaled repeatedly it drives people insane.

(3) But we shall return to these topics when we have time. Perhaps we shall want to show how all these discoveries have flowed from philosophy, the parent of the arts. It first investigated the causes of events, observed their effects, and—the most effective method in the investigation of lightning-bolts—it compared the outcomes of events with their beginnings.

(54.1) Now I shall get back to Posidonius's opinion.[62] The earth, and everything made of earth, produces exhalations, partly damp, partly dry and smoky; the latter is the fuel of lightning-bolts, the former of rain. Any dry, smoky stuff that reaches the air does not tolerate being shut up inside clouds but bursts what encloses it; that creates the sound we call thunder. (2) Also, in the air itself anything that expands simultaneously becomes dry and warm. This too, if it is enclosed, seeks an escape in the same way and exits with a noise; sometimes it breaks out all at once, and so thunders more violently; sometimes bit by bit, gradually. (3) So this breath produces thunder while it either bursts clouds or flies through them; the turbulence of breath trapped in a cloud is a most powerful form of friction.

Thunder, I believe, is nothing other than the noise of air being struck, and it cannot be struck unless it is causing either friction or bursting. **(55.1)** "But," someone objects, "the impact you are looking for also occurs if clouds collide with each other." But not entirely; for whole things are not clashing with whole things, but parts with parts; and soft things do not make a noise unless they are dashed against hard things. So a wave is not heard except when it breaks. (2) "Fire, when plunged in water," someone says, "makes a noise as it is extinguished." Suppose it does: that supports my view. For it is not fire that is making the noise, but breath escaping through whatever is extinguishing the fire. Even if I grant you that fire is both produced in a cloud and extinguished there, it is generated by breath and friction. (3) "Tell me, now," someone says, "can't one of those shooting stars fall into a cloud and be extinguished?" Let us suppose that this too can happen sometimes; we are now looking for a natural, constantly present cause, not an occasional, accidental one. Take it that I admit the truth of what you say, that sometimes fires resembling slanting shooting stars flash out after thunder: but that was not the cause of the thunder; rather, the thunder was produced while that was happening.

(4) Clidemus says that a lightning-flash is not fire but an empty illusion;[63] for at night the sea gleams in the same way when oars move through it. But the analogy is not close: for there the gleam is seen within the water itself, whereas the gleam produced in the air bursts and leaps out.

(56.1) Heraclitus[64] thinks that a lighting flash is like what we see when a fire is trying to get going, like the first, unsteady flame, alternately dying down and flaring up again.

People in the old days called this *fulgetrum*. We speak of *tonitrua* [thunder] in the plural, but in the old days they spoke of *tonitrus* or *tonus*. (I have discovered this in Caecina, a good stylist, who would once have had a reputation for eloquence, if he had not been overshadowed by Cicero.) (2) In the old days they also used a word that we use with one syllable lengthened: for we say *fulgēre* [to flash], just like *splendēre* [to gleam]; but to indicate this burst of sudden light from the clouds, they were in the habit of saying *fulgĕre* with a short middle syllable.[65]

(57.1) You ask what my own view is; for so far I have been lending a hand to other people's opinions. I shall tell you: there is lightning

when a light suddenly flashes over a wide area. This occurs when, as clouds are becoming less dense, air turns into fire but does not find the strength to rush any further forward. (2) You are not surprised, I suppose, either that movement rarefies the air, or that the rarefaction sets it on fire. In the same way a sling-stone liquefies when shot from a sling; drops are formed on it by friction with the air, just as by fire. So there are a lot of lightning-bolts in summer because there is a lot of heat, and fire is generated more easily by the friction of hot things. (3) Both a lightning-flash, which merely shines, and a lightning-bolt, which is propelled, are produced in the same way. But the former is weaker and has less fuel, and, to express my view succinctly, a lightning-bolt is an intensified lightning-flash. So when hot, smoky matter is emitted from the earth, encounters clouds, and swirls around within their hollows for a while, it eventually breaks out, and, since it has no strength, there is a bright flash; (4) but when these lightning-flashes have more fuel and blaze up with greater force, they do not merely appear, but they fall. Some people think that a lightning-bolt always returns,[66] others think that it sometimes comes to rest, when the fuel weighs it down, and the lightning-bolt is driven downward with a weaker impact.

(58.1) But why is the lightning-bolt short-lived and its fire not continuous and steady? Because it is very swift, and its motion is astonishing: it bursts the clouds and ignites the air at the same time, but then the flame dies away as its movement comes to rest. For the swift progress of the breath is not persistent enough to allow the fire to be prolonged. But whenever it is set on fire more vigorously in the turbulence, it attempts a break-out; then, after it has escaped, and the struggle is ending, the same causes sometimes bring it right down to the earth, or sometimes it fizzles out first, if it was ejected with less force. (2) Why does it travel in zigzag fashion? Because it consists of breath, and breath zigzags and meanders; and because nature summons fire upward, violence pushes it downward. Its course starts to zigzag while neither force surrenders to the other, and the fire struggles to rise higher but is pushed down lower. (3) Why are mountain tops frequently hit? Because they confront the clouds, and whatever falls from the sky has to pass by them.

(59.1) I know what you have long been wanting, what you are clamoring for: "I would rather," you say, "not be afraid of lightning-

bolts than understand them. So tell other people how they occur; I want to have my fear of them dispelled, not their nature explained." (2) I obey your summons; for every topic, every conversation, should contain something that furthers our well-being. When we have traversed the secrets of nature, when we have examined the divine, our mind must be set free from its ills and constantly strengthened. This is essential even for experts who devote themselves exclusively to this pursuit, not so that we may escape the blows of circumstance (for weapons are being thrown at us from all directions), but so that we may endure them bravely and resolutely. (3) We can be undefeated, but we cannot be unshaken, though sometimes the hope that we can also be unshaken sneaks up on us. "How do I achieve this?" you ask. Treat death with contempt, and then you have treated all the causes of death with contempt, whether wars or shipwrecks, or the attacks of wild animals, or the weight of debris from a building that suddenly collapses. (4) Can they do any more than separate the body from the mind? No carefulness can avoid this, no good fortune can exempt us from it, no power can overcome it. Fortune varies her allocations of other things, but death summons everybody alike; whether the gods are angry or well disposed, we must die. (5) Let our desperate situation be a source of courage. The most faint-hearted animals have been created by nature to run away, but when no escape is available, they try to fight with their unwarlike bodies. No enemy is more deadly than one emboldened by being cornered, and necessity always inspires a much more violent struggle than courage does; or at any rate the efforts of a great mind and of a desperate one are equal. (6) Let us consider ourselves lost, as far as death is concerned; and so we are. Yes, Lucilius, we are all being preserved for death. All the people you can see, all you can visualize anywhere else, will soon be recalled by nature and laid to rest. There is no question about the fact, just about the date: sooner or later we have to reach the same point. (7) So, does the person who ingratiatingly begs for death to be delayed not seem to you the most cowardly and foolish of all? Would you not despise someone who, when placed in the ranks of those about to die, asked as a favor to be the last to face the executioner? We do the same: we place great value on dying later. (8) Everyone has been sentenced to death, and the sentence is entirely just, because (and this is always an enormous consolation to those about

to face death) those whose case is identical suffer the same fate. We would comply if we were handed over by a judge or magistrate, and would obey our executioner: what difference does it make whether we go to our death because of their orders or because of our birth? (9) How foolish you are, how forgetful of your fragility, if you fear death only when there is thunder! Is that how it is? Does your safety depend on that? Will you live if you escape a lightning-bolt? You will be targeted by a sword, by a stone, by bile. The lightning-bolt is not the greatest of the dangers you face but the showiest. (10) I suppose you will be hard done by if its infinite speed prevents you from being aware of your death, if your death receives expiatory sacrifices, if you are not superfluous even as you breathe your last, but are an omen of some important event. I suppose you are hard done by if you are buried along with a lightning-bolt.[67] (11) But you panic at the crashing of the heavens and tremble at an empty cloud, and whenever there is a flash, you are terrified. So, do you think it more honorable to die from diarrhea than from a lightning-bolt? Well then, stand more bravely in the face of threats from heaven,[68] and when the world is ablaze all around, remember that you possess nothing that requires such a great death to destroy it. (12) But if you think that the turmoil of the heavens and the strife of the storms is being arranged for your sake, if the clouds are gathering and colliding and crashing on your account, if such powerful fires are being unleashed for your destruction, then count it a comfort that your death is so important. (13) But you will have no opportunity for such reflection: this calamity spares us from fear, and among its other benefits is this, that it is swifter than our anticipation of it. People only ever fear the lightning-bolt they have escaped.

Notes

Introduction

1. Book 4, which in some manuscripts and in the early printed editions is presented as a single book, in fact contains the fragments of two separate, incomplete books: the beginning of 4a and the end of 4b.

2. The main evidence for the original order is as follows: the archetype of the manuscripts had the order 4b, 5, 6, 7, 1, 2, 3, 4a; some early manuscripts number book 4b as the third book, book 5 as the fourth, and so on; and several features of the preface to book 3 suggest that it was originally the first book. Hence it appears that 3 and 4a were originally the first and second books, but became physically detached and displaced after a manuscript broke in two, resulting in the loss of parts of books 4a and 4b. See Codoñer Merino 1979, xii–xxi; Hine 1981, 4–23; Gauly 2004, 53–67.

3. See 3.1.2; 3.26.1; 4a.1.1; 5.14.4; 1.15.4.

4. The surviving part of book 4b shows that clouds and rain had been discussed in the lost first part.

5. In Stoicism, the "world" (*kosmos*, *mundus*) consists of the celestial sphere with the fixed stars; the planets, sun, and moon circling below them; and the earth at the center. The "universe" or "whole" also includes the infinite void surrounding the world (*SVF*, 2.522–5). Seneca does not always observe this distinction, for he can use the words *world* and *universe* as synonyms (2.4.2) and can talk about the "whole world" (5.17.5).

6. In psychological contexts, however, I translate "spirits."

7. On breath, see LS, 1.278, 280–89, 292–94; *CCS*, 134–36, 185–86. Different Stoics emphasized its closeness to fire or to air, and Seneca is in the latter camp. Again, he does not always observe the niceties of Stoic terminology, for in 2.6–11 he sometimes uses "air" interchangeably with "breath."

8. See *SVF*, 2.633–45; LS, 1.275–76, 319.

9. On ancient meteorology, see Taub 2003.

10. On the sources, see Hall 1977; Setaioli 1988, 375–452; Gross 1989.

11. In the *Meteorologica* and elsewhere, Aristotle characteristically begins discussion of a new topic with consideration of the views of his predecessors; see Freeland 1990.

12. Seneca's expectations in book 7 were fulfilled by Newton, who first explained the orbits of comets.

13. Book 7 refers several times to a comet that appeared in Nero's reign: this must be the one known to have appeared in 60 CE, and Seneca must have

been writing book 7 before the appearance of another comet in 64, or else he would surely have mentioned it. Book 6 opens with a description of a recent earthquake in Campania, during the consulship of Regulus and Verginius, that is, 63. However, Tacitus dates a major earthquake in Campania to 62. There cannot have been two major earthquakes, for Seneca is emphatic that Campania had never been seriously affected by earthquakes before the one he records. So it seems that either Tacitus or Seneca is mistaken about the date. The problem has been much debated, but in the translation I accept the view that the consular date is interpolated in Seneca's manuscripts. See Hine 2006, 68–72, with earlier bibliography.

14. See Hine 2006, 63–67. Some scholars, notably Gauly (2004), have argued that there is implicit criticism of the emperor elsewhere in the *Natural Questions*, where Seneca attacks vices that later writers associate with Nero. But it is difficult to be certain that such innuendo is present, and in any case it is compatible with due praise being given to Nero elsewhere.

15. See LS, 1.232–33, 259–66.

16. See Berno 2003; Williams 2005a; 2005b; 2006; 2007.

17. On the power of the writing, see Hutchinson 1993, 128–31, 234–39, 284–87.

18. Of course we cannot assert this of books 4a and 4b, which are incomplete.

19. Obeli († . . . †) enclose Latin that is incurably corrupt in the manuscripts.

20. The second half of the book is lost in our manuscripts, but some indication of its contents may be found in John the Lydian; see pp. 63–64.

21. The first part of the book is lost in our manuscripts, but references in the surviving later part show that clouds and rain had been discussed, and the discussion of hail and snow is already in full swing when our texts begin.

Book 3 [originally Book 1]

The title of this book is supplied from 3.1.1. Angle brackets indicate an editorial insertion.

1. It is uncertain who this poet is. He is now generally supposed to be the Vagellius quoted at 6.2.9 (Vagellius frag. 2 Buechner = 2 Courtney), but earlier guesses include Lucilius, Lucan, and Nero.

2. That is, after the destruction of Carthage by the Romans in 146 BCE.

3. That is, to study ethics.

4. That is, good and bad fortune.

5. That is, being prepared to die at any moment.

6. "Quirites" was the traditional title of the Roman people, still used in Seneca's days in formal contexts. Seneca contrasts Roman civic law with the law

of nature. The Stoics believed that the world is controlled by divine reason and so conforms to universal laws (see, e.g., LS, 1:267, 327); in Seneca compare, for example, 3.15.3; 3.16.4; 3.29.3; 1.praef.3; 2.35.2; see also Inwood 2005, 224–48.

7. The Stoics said that only the wise man is free; vice is a form of slavery. See *SVF* 3.589–603 (cited by volume number and passage numbers).

8. That is, "Why am I exhausting myself with farming, or in public life?"

9. Some think this refers to what has been said above, not to what follows.

10. That is, rivers, springs, lakes, and so forth, as opposed to "celestial" waters, that is, clouds, rain, snow, and so forth.

11. Ovid *Met*. 3.407. Seneca uses the quotation to represent the theory that rivers come from underground via springs.

12. Virgil *Aen*. 1.245–6, from a passage referring to the River Timavus, near Trieste, a very short but fast-flowing river whose waters were said in antiquity to taste of salt. The quotation represents the theory that rivers ultimately get their water from the sea.

13. Here and at 4a.praef.9 Seneca actually addresses Lucilius by his cognomen Iunior: his full name was Gaius Lucilius Iunior.

14. Lucilius Iunior frag. 4 Buechner = 4 Courtney. This fragment represents the theory that rivers can flow underground for part of their course, for it alludes to the traditional belief that the River Alpheus went underground near Elis in the Peloponnese and reappeared in the spring of Arethusa in Syracuse in Sicily.

15. The Nile is the subject of book 4a.

16. In the manuscripts this sentence is the second sentence of chap. 2.1; it was transferred here by Codoñer Merino. Rain water is "collected," spring water is regularly described as emerging from "veins" in the earth; see especially 3.15.

17. Here "breath" (see the introduction, on 'The *Natural Questions* and Stoic Physics') is virtually equivalent to "wind."

18. From the Presocratics onward, philosophers had speculated about how one element can change into another. Aristotle discussed the matter in *De Generatione et Corruptione*. For Stoic views, see LS, 1:280; 286–87; *CCS*, 135–36.

19. That is, earth and water both sink toward the center of the world, which is one of the extremities of the world because it is the furthest point from the outer heavens, the other extremity.

20. Theophrastus frag. 216 Fortenbaugh.

21. Cassander was king of Macedon from 316 to 297 BCE.

22. Greek philosopher of the early sixth century BCE.; see DK11A12.

23. Referring to the Stoic doctrine of ecpyrosis, in which the whole cosmos is consumed in fire at the end of each cosmic cycle. See LS, 1:274–79.

24. DK11A15.

25. Asterisks indicate that something is missing from the Latin text. Here Seneca may have written something like "<it is not likely that the earth floats on water,> and . . ."

26. Seneca here uses the language of senatorial procedure.

27. Referring to igneous rocks formed from lava, but also to various minerals and precious stones (see, e.g., 3.25.12).

28. See 3.10.

29. An illness that (supposedly) produced bouts of intense fever every three days.

30. Theophrastus frag. 217 Fortenbaugh.

31. In the expectation of inheriting the father's wealth.

32. The text and interpretation of this sentence is very uncertain.

33. Ovid *Met.* 15.313–4. This and the two quotations of Ovid that follow are all taken from the long speech on the topic of change delivered by Pythagoras in *Met.* 15, from a section on remarkable rivers, lakes, and springs.

34. A volcanic ash that was quarried at Puteoli (modern Pozzuoli) and used to make a concrete that sets under water.

35. The name of the lake is incurably corrupt in the manuscripts.

36. Ovid *Met.* 15.320–21.

37. Ovid *Met.* 15.329–31. Ovid wrote "the river of the Lyncestae," a Macedonian tribe; Seneca, or maybe a scribe, got the name wrong.

38. A philosopher from Sicily, c. 492–432 BCE; see DK31A68.

39. Melas is Greek for "black." The other river is the Cephisus.

40. Theophrastus frag. 218D Fortenbaugh.

41. The name of the river is missing from the manuscripts but supplied by Gercke from Pliny *HN* 31.14.

42. Square brackets indicate words that are interpolated in the Latin manuscripts.

43. Theophrastus frag. 206 Fortenbaugh.

44. "Rock-crystal" here refers to clear quartz.

45. In book 4a.

46. Theophrastus frag. 211D Fortenbaugh.

47. On the stars feeding on exhalations, see 2.5.

48. Ovid *Met.* 15.273–76 (with some changes of wording; e.g., the last word in Ovid is not "waves" but "fields"). This is another passage from the speech of Pythagoras (see above at 3.20.3).

49. See the quotation from Lucilius in 3.1.1 and the note there.

50. Virgil *Ecl.* 10.4–5. Arethusa is here treated as a nymph. Doris is a sea-goddess.

51. On some issues Seneca admits only a single explanation: for instance, body is a continuum, and not composed of atoms and void (see 2.6–7); and the

world is controlled by fate, not the product of chance (see, e.g., 1.praef.14–15). But on some of the topics discussed in the *Natural Questions* he allows that there may be multiple explanations, sometimes operating simultaneously, sometimes separately on different occasions (see, e.g., 4b.8; 5.5.1). Epicurus and Lucretius had insisted that multiple explanations were appropriate in physics; see 6.20.5–7; LS, 1:92–93, 95–96.

52. This phrase, "According . . . think," should perhaps be attached to the end of the previous sentence. Papirius Fabianus, a declaimer and philosopher active in Rome in the early imperial period, was one of Seneca's teachers.

53. By people trying to make the acorns fall off.

54. Ovid *Met*. 2.264, where the context is very different, not a flood, but the seas are being dried up as Phaethon flies the sun's chariot too close to earth.

55. Ovid *Met*. 1.292. This and the following quotations are from Ovid's description of the mythical flood that destroyed all mankind except for Deucalion and his wife Pyrrha.

56. Ovid *Met*. 1.304.

57. Ovid *Met*. 1.285–88a; 289b–290; Seneca (or the manuscript tradition) omits two half-lines.

58. Ovid *Met*. 1.272–73.

59. For the Stoics, aether (a Greek loan-word in Seneca) was the purest form of fire, found in the heavens (whereas for Aristotle, it was a fifth element).

60. See 3.13.1 on ecpyrosis.

61. Beros(s)us was a third-century BCE Babylonian who wrote in Greek on Babylonian history. Belus here is a legendary early Babylonian, though the name is originally a Greek form of the name of the god Bel or Baal.

62. That is, the planets.

63. The Stoics.

64. See 3.9.3–10.1.

65. Charybdis and Scylla were mythical sea-monsters, identified with a whirlpool and a rock in the straits of Messina, between Italy and Sicily.

66. See 3.27.2.

Book 4a [originally Book 2]

1. *Imperiosi (sumus)*, translated "we bully," is related to *imperium* in (1) above, translated as "governorship."

2. Here and in what follows Seneca uses several metaphors from gladiatorial or military combat.

3. One branch of the manuscripts here adds "Perhaps he is attacked precisely because he is exposed."

4. It is not certain which Plancus is meant: possibly Lucius Munatius

Plancus, a prominent military and political figure in the late Republican and Augustan period (consul in 42 BCE); or his son (consul in 13 BCE).

5. Probably Lucius Vitellius (consul in 34, 43, and 47 CE, father of the future emperor Vitellius; probably died in the 50s); Tacitus says he became notorious for "shameful flattery" (*Ann*. 6.32).

6. A friend of Seneca's; an orator and prominent public figure (consul in 27 and 44 CE; died by 47; latterly married to Agrippina, mother of Nero).

7. A Cynic philosopher, Seneca's contemporary and friend.

8. Annaeus Fidus and Apollonius are not otherwise known (but the name Annaeus suggests perhaps a freedman of Seneca's or someone in his family—and Fidus, ironically in this context, means "faithful"). A Thracian was a gladiator armed like a Thracian, with a small, round shield and curved sword.

9. See 3.1.1.

10. Seneca's elder brother, Annaeus Novatus, later, after adoption, called Lucius Iunius Gallio Annaeanus.

11. The official attendants of senior Roman magistrates.

12. Gaius, emperor 37–41 CE, had Gnaeus Cornelius Lentulus Gaetulicus, legate of Upper Germany, executed on a charge of conspiracy in 39. Valeria Messal(l)ina was wife of the emperor Claudius, until she was forced to suicide in 48. Narcissus, a freedman of Claudius, was forced to suicide just after Claudius's death in 54.

13. That is, suicide.

14. Virgil *Aen*. 4.373 (where Dido is speaking to Aeneas about his betrayal of her).

15. Ovid *Met*. 1.241–42 (where Jupiter is speaking about the wickedness of the human race). Erinys is another name for Fury.

16. Menander frag. 931 Koerte. The original context of the passage of Menander here referred to is unknown, though some attribute it to a comedy called *The Rustic (Agroikos)*. When Seneca says, "the poet has leaped onto the stage like a rustic," he probably means that the words spoken by a rustic character sound as though they express the poet's own feelings, but the passage is difficult.

17. A legal phrase describing the procedure for laying claim to something that belongs to you.

18. The "best part of us" is the mind.

19. The first Punic war between Carthage and Rome (264–41 BCE) was fought mainly for control of Sicily.

20. From 43 BCE onward, Sextus Pompeius, the son of Pompey the Great, controlled Sicily with a navy and fought off attacks by the members of the second triumvirate, Antony, Octavian, and Lepidus, until his defeat at the battle of Naulochus in 36. Caesar here is Octavian, the later Augustus. Lepidus's forces deserted him and went over to Octavian.

21. An allusion to Sicily's large-scale corn production, on which Rome depended.

22. See 3.1.2; 3.26.1.

23. Unless "not" is inserted, Seneca flatly contradicts all the other ancient evidence about the rising of the Nile, and his argument is inconsistent. The Dog Star (Sirius) was generally said to rise in late July.

24. "My favorite poet" is probably Lucilius; it seems that the preceding quotation is a deliberate alteration of what Lucilius wrote.

25. These words occur not in our texts of Ovid, but in Tibullus 1.7.26, a passage about Egypt and the Nile; Seneca's memory seems to have let him down about the author.

26. Philae was near Aswan (the original island is now submerged), but here Seneca confuses it with Meroe, much further south, where the Atbara flows into the Nile.

27. In Greek this means "not to be trodden on."

28. Or "in many nameless branches."

29. Balbillus was prefect of Egypt from 55 to 59 CE. It is disputed whether he was identical with Tiberius Claudius Balbillus, a prominent military and political figure under Claudius, and with a Balbillus who wrote on astrology.

30. Theophrastus frag. 214B Fortenbaugh.

31. 42 and 41 BCE. Antony and Cleopatra both died in 30 BCE, the year after the battle of Actium.

32. Callimachus frag. 44 Pfeiffer.

33. Greek philosopher of the fifth century BCE; see DK59A91.

34. Aeschylus *Supp.* 559, inc. fab. frag. 300.4–5 Radt; Sophocles, inc. fab. frag. 882 Radt; Euripides *Hel.* 3, *Archelaus* frag. 228.3–5 Nauck^{2} = 228.3–5 Kannicht.

35. The text and translation here are uncertain. With the above rendering, there is the problem that the Cayster and Mount Tmolus are in Asia Minor, and so not really "northerly." This could be an oversight of Seneca's, or there could be corruption in the text.

36. Cf. DK11A16. See also 3.13.1.

37. Etesian (Greek for "annual") winds were any regular, seasonal winds, particularly north or northwesterly winds that blow in the Mediterranean during summer.

38. Greek explorer and geographical writer of the sixth to fifth centuries BCE. See *FHG*, 4:408 (cf. Jacoby, in *RE* 6:1509–11).

39. Euthymenes, despite Seneca's objections below, was presumably speaking of etesian winds that blew from the west or southwest, forcing more water from the Atlantic down the Nile toward Egypt.

40. Seneca presupposes the widely held theory that the saltiness of the sea is caused by the impurities left behind when the pure water is evaporated by the sun.

41. Greek astronomer and mathematician of the late fifth century BCE; see DK41A11.

42. Greek philosopher of the late fifth century BCE; see DK64A18 = Diogenes T35a Laks.

43. Lydus, *De mensibus*, ed. R. Wünsch (Leipzig: Teubner, 1898) 4.107, pp. 146.3–147.6.

44. See Herodotus 2.24–27.

45. Greek historian of the fourth century BCE; see *FGH*, 70F65b.

46. Greek philosopher of the fifth century BCE; see DK35A1.

47. Greek historian of the fourth century BCE, a nephew of Aristotle; see *FGH*, 124F12(a).

48. Greek writer of the fourth century BCE who wrote on history, philosophy, and geography, and was a student of Aristotle's. See Dicaearchus frag. 113 Wehrli.

Book 4b [originally Book 3]

1. That is, they can report only what they have heard from others.

2. Ovid *Ars* 1.475–76.

3. Lucretius 1.313. This is the only quotation from Lucretius in the *Natural Questions*.

4. One may infer that Anaxagoras was ridiculed in the lost part of the book, perhaps because of his assertion that snow is really black (see Harry M. Hine, "Seneca and Anaxagoras on Snow," *Hermes* 108, no. 4 [1980]: 503; Gross [1989], 195). See also 4a.2.17.

5. This was presumably said in the lost first part of the book.

6. Virgil *G.* 1.313 ("our" Virgil because he was a fellow Roman).

7. There was a Greek proverb that said "Run risks with a Carian" (i.e., instead of taking risks yourself). Many Carians were slaves or mercenaries.

8. Seneca quotes the Greek word, which means "hail-guards."

9. It was a proverbial idea in Greek and Latin that the gods are susceptible to gifts.

10. A Roman law code of the fifth century BCE. See M. H. Crawford, ed., *Roman Statutes*, vol. 2 (London: Institute of Classical Studies, University of London, 1996), 682–84.

11. As at the end of a play in the theatre.

12. Greek philosopher of the fifth century BCE, one of the first atomists. (This passage is not in DK.)

Book 5 [originally Book 4]

1. Virgil *Ecl.* 2.26.

2. The phrase "form of words," *formula*, alludes to the legal use of the word to describe the formal statement of the nature of the dispute drawn up by the plaintiff and the defendant together with the judge. Slipshod drafting of the *formula* might lead to one's losing a case; likewise Seneca has treated the definition of wind as something that needs careful drafting to avoid accusations of error.

3. DK68A93a. See also 4b.9.

4. It was said that certain flies were generated from fire; see, e.g., Aristotle *Hist. an.* 5.19, 552b10 ff.

5. This sentence appears to be out of place. Codoñer Merino suggested deleting it.

6. Meaning "produced in or from a bay."

7. The Stoics adopted the much older idea that the heavenly bodies have their fire constantly "fed" by exhalations from the earth, and regarded the whole world as a rational animal; see LS, 1:274–79.

8. 5.8.2.

9. See 4a.2.22.

10. As it stands in the manuscripts, this statement that the etesians "do not last" beyond the rising of the Dog Star (Sirius) conflicts with all the other ancient evidence and with the logic of the passage (see next note). Seneca perhaps wrote something like "and are still [or: are just as] strong beyond. . . . "

11. A difficult sentence, but the sense seems to be that after the solstice, when the sun is moving south along the ecliptic toward the equator (the region "where it is more directly overhead"), it is pushing air southward ahead of it—air that constitutes the etesian winds—and pulling other air toward it from the north. This pulling process is not explained, but compare 2.20.3 for a similar process in a different context.

12. See 5.8. Seneca here reverts to discussing the *encolpias*.

13. See 4a.praef.10.

14. Meaning "from a cloud"; that is, a cloudburst.

15. That is, by thunder and lightning.

16. See 5.4.

17. Ovid *Met.* 1.388; but Seneca misquotes or misremembers the phrase and takes it out of context, for Ovid wrote "obscure with dark hiding-places," a metaphorical description of the riddling words of an oracle.

18. See 6.12 ff.

19. Asclepiodotus's views on scientific topics are known only from Seneca, but he was very likely also the author of the extant *Tactica*, a treatise on military tactics.

20. Most likely Philip II (382–336 BCE), king of Macedon and father of Alexander the Great. See 3.praef.5.

21. "Their ruin": that is, the earth above threatened to collapse on them; but also a symbol of the moral ruin of greed.

22. Seneca here, and just below, draws on the idea, much exploited by ancient philosophers, that man alone of the animals stands upright, being designed to look up to heaven, not down at the earth.

23. Roman tombstones regularly said "May the earth lie lightly on you" (*sit tibi terra leuis*) or something similar.

24. That is, gold.

25. The constellation of the Plough, or Ursa Major, or the Great Bear; a northern constellation, so used as a metonymy for the northern regions of the earth.

26. Ovid *Met*. 1.61–66; part of Ovid's description of the creation.

27. Virgil *Aen*. 1.85–86, from the description of the storm that wrecked Aeneas's fleet near Carthage. The African wind was southwesterly (see 5.16.5 below) but here does duty for the west wind.

28. M. Terentius Varro (116–27 BCE), public figure, scholar, and prolific writer. His *On Agriculture* and part of his *On the Latin Language* survive, and there are fragments of many other works.

29. That is, at the same point on the horizon in any given location.

30. In this chapter it seems best to transcribe the Latin and Greek names, although elsewhere some of them have been translated (e.g., *eurus* as "east wind," *auster* as "south wind," etc.).

31. The historian Livy (probably 59 BCE to 17 CE). Seneca refers to the battle of Cannae in 216 BCE. In Livy's account of it the wind is named twice (Livy 22.43.10; 46.9).

32. Seneca writes as though the winds occupied places at a Roman dining table: the "most important" place is on the right (i.e., NNE); the lowest on the left (NNW).

33. That is, "the Thracian wind."

34. That is, grammatical cases.

35. The Greek word *horizon* means "separating" (i.e., separating the visible hemisphere from the invisible). In this case Seneca is happy to use the Greek loan-word rather than the Latin versions.

36. C. Marius (c. 157–87 BCE), a highly successful general, but also prominent in the political violence and civil war of the early first century. Livy wrote about him in book 80, which does not survive (see *Per*. 80; frag. 48 Weissenborn-Müller = 20 Jal).

37. That is, while still at sea or after we have landed.

38. Xerxes, who invaded Greece in 480 BCE. His forces were defeated at Salamis and Plataea.

39. That is, the ocean.

40. M. Licinius Crassus, member of the first triumvirate, who invaded Parthia in 55 BCE and was killed after the battle of Carrhae in 53. The tribune in question was C. Ateius Capito.

41. See 5.18.5.

42. In a Roman trial the witnesses were called at a late stage, after all the advocates for the prosecution and defense had delivered their speeches; hence "near the end." Nothing in Plato's surviving works corresponds closely to what Seneca says, though there is some resemblance to *Resp*. 520c, 586a–b.

43. Or perhaps, reading *uita parari*, " . . . reflect that people pay with their lives for the acquisition of things on which life is wasted."

Book 6 [originally Book 5]

1. See the introduction, note 13, for the argument that the names of the consuls of 63 CE have been interpolated, and the earthquake occurred in 62 CE.

2. Seneca returns to these phenomena below at 6.27–30.

3. The sudden collapse of old or badly constructed buildings was a regular hazard in the Roman world; cf. 6.1.12; 2.59.3.

4. "Threats from heaven" is a Virgilian phrase for lightning (*Aen*. 6.113; 10.695); cf. 2.59.11.

5. Virgil *Aen*. 2.354, spoken by Aeneas to his men during the fall of Troy.

6. That is, we can choke to death on our own phlegm.

7. Vagellius frag. 1 Buechner = 1 Courtney. The poem of Vagellius does not survive, but the quoted words may well have been spoken by Phaethon, when, in the myth, he was pleading with his father, the Sun-god, to be allowed to drive his chariot, despite the risks involved.

8. For Epicurus and Lucretius, the main reason for studying physics was to free people from fears based on the false belief that the gods were the cause of frightening natural phenomena; see LS, 1:155–57. In Seneca, see also 2.41–46.

9. These phenomena were all treated as prodigies in Roman religion. They are discussed by Seneca in book 7 ("long-haired stars," or comets) and book 1 (the other phenomena).

10. Cf. DK, 1:486.34–35. See also 3.13.1.

11. Seneca appears to confuse the Danube with the Tanais (Don), which was generally regarded as dividing Europe from Asia. There is the same confusion in one of Seneca's tragedies, *Troades* 9. (Some regard "and forming . . . and Asia" as an interpolation.)

12. It is debatable whether this paragraph should be punctuated as a continuation of the theory in the previous paragraph, or as Seneca's own words.

13. See 3.1.1.

14. DK59A89. See also 4a.2.17.

15. A reference to volcanic fire within the earth.

16. Greek philosopher of the sixth century BCE; see DK13A21.

17. Greek philosopher of the fifth century BCE; see DK60A16a.

18. See Aristotle *Mete*. 2.8; Theophrastus frag. 195 Fortenbaugh. The name Theophrastus in Greek means "divinely eloquent."

19. Strato of Lampsacus was head of the Peripatetic school after Theophrastus (c. 287–269 BCE). See Strato frag. 89 Wehrli, and frag. 47.

20. Virgil *Aen*. 6.256, from a description of the arrival of the goddess Hecate.

21. It seems that the rest of this sentence is missing from the manuscripts.

22. The Stoics said that even inanimate objects are permeated by breath *(pneuma*, *spiritus)*, which they need to give them coherence; see the introduction.

23. See 5.8.1.

24. Virgil *Aen*. 8.728; this line, from the description of the shield of Aeneas, describes the river Araxes (modern Aras), a river in Armenia that was bridged by Augustus.

25. The phrase as it stands, and as translated literally above, is highly problematic, and it is here regarded as an interpolation. Others think the phrase gives the title of Asclepiodotus's work, in corrupt form. On Asclepiodotus, see 5.15.1.

26. Virgil *Aen*. 1.55–56, where the verb is plural, and the line refers to the winds that the god Aeolus keeps imprisoned in his island home.

27. Virgil *Aen*. 1.53–54, from the same passage about Aeolus and the winds.

28. A fourth century BCE atomist philosopher, follower of Democritus; see DK70A21.

29. DK68A98. See also 4b.9.

30. 341–270 BCE; atomist philosopher and founder of the Epicurean school. See Epicurus frag. 351 Usener = 173 Arrighetti^{2}.

31. Thera, or Santorini, and the smaller island of Therasia were remnants of a large volcano in the southern Aegean. The recently formed island was called Thia (modern Aspronisi). See also 2.26.4–6. "Sailors" is a conjecture; the manuscripts have "as we watched," but it is unlikely that Seneca claimed that the eruption was widely observed.

32. Posidonius frag. 230 Edelstein-Kidd = 320 Theiler.

33. That is, a Latin term.

34. Something is missing, perhaps "just as <I have said>," or "just as <we experienced recently>" (cf. 6.1.2).

35. On Asclepiodotus, see 5.15.1.

36. Virgil *Aen*. 8.525; part of a description of a bolt of lightning.

37. See 6.12 ff.

38. See book 4a, note 47.

39. Helice and Buris (also called Bura) were towns in Achaea, on the south of the Gulf of Corinth. See *FGH*, 124F19.

40. See 6.15.

41. The Greek word means "Earth-shaker," a regular epithet of Poseidon (the Greek counterpart of Neptune) in Homer.

42. But Thucydides 3.89.3 says only that the island was damaged.

43. Posidonius frag. 232 Edelstein-Kidd = 321 Theiler.

44. Homer *Od.* 354–57. Pharos in Seneca's day was on the coast of Egypt.

45. Virgil *Aen.* 3.77; "he" is Apollo.

46. Pindar frag. 33c–d Snell-Maehler.

47. Thucydides 2.8.3.

48. *FGH*, 124F20.

49. Seneca has not in fact said this in our text of the *Natural Questions*: his memory may let him down; or the passage where he said it could be missing from our manuscripts; or some think there must be something wrong with the text at this point.

50. A poetic name for Italy.

51. Virgil *Aen.* 3.414–19.

52. In Seneca's day there were three Spanish provinces: Hispania Tarraconensis, Baetica, and Lusitania.

53. A reference to Stoic ecpyrosis; see 3.13.1.

54. C. Laelius (c. 190–after 129 BCE) was a prominent political figure who acquired the nickname "Wise" (Sapiens) because of his close association with Greek philosophers.

Book 7 [originally Book 6]

1. That is, of the world.

2. The moon "struggling" is a Latin idiom for the moon being eclipsed. To stop eclipses, people traditionally made a loud noise, either shouting or clanging metal objects.

3. That is, every day the sun rises and sets at a different point on the horizon from the previous day.

4. Referring to the fact that (in the northern hemisphere) from the summer solstice to the winter solstice the sun rises less high in the sky each day, making the days shorter and the nights longer.

5. DK68A92. See 4b.9.

6. That is, the five then-known planets, Venus, Mercury, Mars, Saturn, and Jupiter.

7. Eudoxus of Cnidus (c. 390–c. 340 BCE), Greek mathematician, astronomer, and geographer.

8. Greek mathematician and astronomer of the third century BCE.

9. The Chaldaeans were a people of southern Mesopotamia, associated particularly with astrology. Epigenes and Apollonius of Myndus are of uncertain date, and most of what we know about them comes from this book by Seneca. Here "horoscope" has the ancient sense: a prediction about a person's life based on the configuration of the stars and planets at the moment of conception or birth.

10. *Sublimium* is normally taken to mean "of the heavenly bodies," but see J. R. Bravo Díaz, "'Aer, aether, caelum, sublimis': Del vocabulario técnico utilizado para designar el "cielo" en las *Naturales Quaestiones* de Séneca y otros escritores científicos," *Voces* 6 (1995): 9–39, at 23.

11. Here and in chap. 5 below, the word *beam*, applied to bright objects seen in the sky, literally denotes a wooden beam, not a beam of light; see also 1.1.5.

12. Unknown apart from this passage.

13. DK59A83. See also 4a.2.17.

14. *FGH*, 124F21. See also book 4a, note 47.

15. See 6.23.4.

16. Aristotle *Mete*. 1.6, 343b1–25.

17. In 54 and 60 CE. The punctuation assumes that this is a comment inserted by Seneca in his account of Epigenes' ideas.

18. Sallust *Hist*. 4, frag. 28.

19. Ovid *Met*. 2.71.

20. Presumably, people with weaker eyesight can see only the "hairs" concentrated in the tail of the comet, but those with sharper eyesight can also see "hairs" spreading out from the comet's body; but text and interpretation are uncertain.

21. Presumably the same as the Artemidorus of Parium in 1.4.3, but not otherwise known.

22. This passage is very obscure, and there seems to be something missing here.

23. Demetrius I of Syria lived from 187–150 BCE, and the war between the Achaean confederacy and Rome was in 146–145. The comet appeared in 147 according to Obsequens 20.

24. Attalus III was king of Pergamum from 138 to 133 BCE.

25. *FGH*, 70T14b, F212. See book 4a, note 45.

26. See 7.4.1.

27. The four comets here referred to appeared, respectively, in 54 CE, 14 CE, 60 CE, and 44 BCE. The word *departure* was applied to the deaths of Roman rulers who were declared to be gods after their death; see 1.16.3.

28. This refers to the planets, whose distance from the earth varies as they and the earth orbit the sun, producing variations in their visible size and brightness.

29. Zeno of Citium, the founder of Stoicism; *SVF* 1.122.

30. Virgil *G.* 1.367; also quoted at 1.14.2 (with a different word order).

31. Posidonius frag. 132 Edelstein-Kidd = 322 Theiler.

32. Virgil *Aen.* 9.20–21; Turnus is describing what he sees in broad daylight.

33. Posidonius frag. 132 Edelstein-Kidd = 322 Theiler.

34. Seneca runs through the principal philosophical theories about the mind (or soul): the Stoics said that it was breath and a portion of god (see LS, 1:313–23); the view that it was a harmony was particularly associated with the Pythagoreans (cf. DK44A23, 53.4); the Epicureans said it was the finest part of the soul (see LS, 1:65–72); the view that it was incorporeal was particularly associated with Aristotle (cf. *De an.* 2.1, 412a27–28); Empedocles said it was blood (DK31B105); and various Presocratic philosophers said it was heat (DK67A28, 68A102). See also *CCS*, 295–301.

35. Virgil *G.* 1.137.

36. Saturn, which has the longest orbit of the planets known in antiquity.

37. Venus.

38. Aristotle *Mete.* 1.7, 344b18–20; Aristotle in fact says that comets indicate wind and dry weather.

39. Virgil *Georg.* 1.392; the passage includes the behavior of an oil lamp in a list of weather signs.

40. Virgil *G.* 1.362–64.

41. See 7.4.1.

42. 60 CE.

43. Theophrastus frag. 193 Fortenbaugh.

44. Aristotle frag. 14 Rose = 943 Gigon.

45. Panaetius was a Stoic philosopher, c. 185–109 BCE, head of the school from 129–109; see Panaetius frag. 75 Van Straaten.

46. The sanctuary of Demeter and Kore at Eleusis in Attica was the site of the Eleusinian mysteries, which were still celebrated in Seneca's day.

47. In the gladiatorial schools effeminate men were segregated from the rest and had their own kind of armor (see Juvenal *Satire* 6.365.O7–13).

48. The Academy was the school founded by Plato in the fourth century BCE. From the mid-third century to the first half of the first century BCE, known as the period of the New Academy, Skepticism was prevalent in the school.

49. Pyrrho of Elis (c. 365–275 BCE); Greek philosopher, founder of Skepticism.

50. Q. Sextius (Augustan period), founder of the school, and his son, probably Sextius Niger.

51. Pantomime actors of the Augustan period.

52. That is, from acting (wearing a mask), they turn to gladiatorial fights.

Book 1 [originally Book 7]

Late manuscripts and editors supply various titles, such as "On Celestial Fires."

1. Hellenistic philosophers distinguished three branches of philosophy: logic, ethics, and physics. Seneca here ignores logic, contrasting ethics and physics—but he concentrates on theology, which in this scheme was one branch of physics.

2. The Epicureans said that the gods take no notice of human beings; see LS, 1:57–65.

3. The Stoics identified god with nature, providence, fate, and necessity; see 2.45.2; LS, 1:275, 323–33; *CCS*, 133–38, 153–78.

4. That is, philosophy.

5. The earth was commonly said to be the size of a dot or pinprick in relation to the entire universe, but Seneca is here thinking particularly of a famous passage in Cicero's *Republic*, the "Dream of Scipio," where Scipio dreams that he is taken up to the Milky Way and looks down at the Roman empire, which seems to be the size of a pinprick (Cicero *Rep*. 6.16).

6. Seneca here speaks ironically, as though he is dictating where the boundaries should lie both between the Roman empire and its neighbors, and between provinces within the empire. The Dacians, north of the lower Danube, the Parthians, east of the Euphrates, the Sarmatians, northwest of the upper Danube, the Germans, east of the Rhine, and the Ethiopians, to the south of Egypt, were all beyond the empire's boundaries. The Haemus mountain range in Seneca's day separated the provinces of Thrace and Moesia, and the Pyrenees separated Aquitania and Gallia Narbonensis, two of the Gallic provinces, from the Spanish provinces (see 6.30.3).

7. Virgil *Aen*. 4.404, from a simile in which the Trojans are compared to ants; the word *narrow* occurs in the next line of Virgil, as in Seneca.

8. That is "even if your kingdoms stretch from one side of the inhabited world to the other." The Greeks and Romans thought that the whole inhabited landmass, including Europe, Asia and Africa, was surrounded on all sides by the ocean.

9. That is, the mind observes the point on the horizon at which the star rises, the highest point of its course across the sky, and the point on the horizon at which it sets. The phrase "the highest part of its course" seems to be an interpolated explanation of "zenith."

10. Seneca is probably thinking of the journey eastward from Spain to India (which involved crossing Egypt by land, from the Mediterranean to the Red Sea). But in the Renaissance Columbus and others thought he was talking about a voyage from Spain westward; see D. Clay, "Columbus' Senecan Prophecy," *American Journal of Philology* 113, no. 4 (1992): 617–20.

11. Saturn; see 7.27.4.

12. This sentence, which appears in some brief excerpts from the *Natural Questions* in a ninth-century manuscript from the circle of Alcuin, may have been known to Anselm and may have influenced the phrasing of his arguments for the existence of god in the *Proslogion*. See Harry M. Hine, *Classical Quarterly* 42, no. 2 (1992): 558–62, at 560–61, with bibliography.

13. Seneca is referring to the world.

14. Principally the Epicureans.

15. This section deals with meteors, commonly called shooting or falling stars. An unusually large meteor is today called a fireball or bolide.

16. Aristotle *Mete*. 1.4 talks about "shooting stars and what are called 'torches' and 'goats' by some people" (341b3–4), and later says that the "goat" gives off sparks as it burns (341b30–3); Seneca does not give these details.

17. The Kids were two stars (modern astronomy counts three) close to Capella ("the She-Goat") in the constellation Auriga. (Probably Seneca employs the name in this familiar way; it has also been suggested that *kids* is another term for a type of meteor, but that use of this word is not otherwise attested.)

18. The third Macedonian war, 171–168 BCE.

19. 14 CE. On the use of the word *departure*, see 7.17.2.

20. Sejanus, a powerful Praetorian prefect under Tiberius, was executed for treason in 31 CE.

21. Germanicus, adopted son of Tiberius, died in 19 CE; it was widely believed that he was poisoned.

22. Seneca again discusses the issue of how some events can be signs of others in 2.32–51, particularly 41–42.

23. See 7.4.3.

24. Virgil *Aen*. 5.528. Seneca is distinguishing normal meteors from larger fireballs or bolides.

25. Aristotle *Mete*. 1.4, 341b6–10. Seneca gives a very brief and free account of Aristotle's ideas.

26. Sirius, in Canis Major.

27. St. Elmo's fire, an electro-luminescent phenomenon.

28. Gylippus was a Spartan general during the Peloponnesian war with Athens; he was sent to Syracuse, in Sicily, in 414 BCE.

29. This chapter deals with what in modern meteorology are still called coronae (this Latin word is here translated "garlands," to preserve the basic meaning). Coronae are a series of concentric rings of different-colored light formed round the sun or moon by diffraction of light in water droplets in the atmosphere.

30. April or May, 44 BCE.

31. Note that the modern scientific term *halo* describes a different phenomenon from the ancient Greeks' halo, which in modern terminology is a corona:

haloes are single rings of light round the sun or moon, produced by refraction in ice crystals in the upper atmosphere.

32. "They" could refer to the clouds, but more likely it refers to unnamed writers who are said to "generate" the rainbow.

33. Ovid *Met*. 6.65–67.

34. See 1.12.1, 1.17.2–3 on the use of bowls of oil or pitch to observe the sun. The thousand bowls are of course a rhetorical "thought experiment."

35. Aristotle *Mete*. 3.4, 373a35–b28.

36. Heraclitus (DK22B3) and Epicurus (frag. 345 Usener) held this view.

37. Saturn, though its perceived motion is very slow, has to cover vast distances, so it moves very fast (see 7.27.4; 1.praef.13); there is a progression from the sun to Saturn to the heavens. Parroni (2002) prints the conjecture *omnes* for *omnium*, by A. Mele, giving a reference to the sun: "none of us sees its (sc. the sun's) motion, but we all know it is very fast."

38. This clause is obscure: perhaps Seneca assumes (though he nowhere states) that the sun, the observer, and the cloud need to be in a straight line (or, more precisely, on the same vertical plane) for a rainbow to be visible.

39. Aristotle does give a geometrical account of the formation of the rainbow (*Mete*. 3.5).

40. That is, proofs that are accessible to everybody: in Roman law there was a difference between the raised platform (*tribunal*) on which magistrates and legal experts sat and acted in an official capacity, and ground level, where ordinary people stood. Seneca seems to have thought that Roman readers could not cope with the geometry.

41. Artemidorus is of unknown date. He is usually identified with the Artemidorus of book 7 (7.13), and outside Seneca is only encountered in a Byzantine astrological treatise (*Catalogus Codicum Astrologorum Graecorum* 1.80, 5.204).

42. A line from a lost poem by Nero, describing the iridescence of the feathers on a dove's or pigeon's neck (frag. 2 Buechner = 2 Courtney). The Cytheran is Venus, who was associated with the Aegean island of Cythera.

43. Posidonius frag. 134 Edelstein-Kidd = 323 Theiler.

44. Virgil *G*. 1.380–81, from a passage describing various signs of rain; the Greeks and Romans thought of rainbows as signs that rain was on the way (as opposed to the biblical use of the rainbow as a sign that the rain is over). The rainbow "drinking" was a traditional Roman idea.

45. The brief discussion of rainbows as weather signs in this paragraph starts very suddenly and seems to interrupt the surrounding arguments about the causes of rainbows. It does not fit very well at any other point in the book either, so it may be an afterthought of Seneca's inserted in an awkward place.

46. See 1.5.6.

47. See 1.2, on garlands. This short section, which poses questions without

giving answers, reads like a brief note that is not developed or integrated into the context.

48. Aristotle *Mete.* 3.5, 377a11–28.

49. "Rods," nowadays called sun pillars, are not related to rainbows, but are caused by reflection of sunlight from ice-crystals in the atmosphere. As Seneca says, they appear next to the sun, not opposite it: a column of light appears above the sun, usually when it is near the horizon; the color can vary, but there are no spectral colors.

50. Already discussed in 1.2.

51. Seneca alludes to two possible explanations of the Greek compound *par-helion*, "beside the sun," or "equivalent to the sun." The modern name is *parhelia* (sing. *parhelion*), or *sun dogs*. They appear on either side of the sun at an angle of about 22° from it, and are caused by ice crystals in the upper atmosphere.

52. Virgil *G.* 2.95–96. But Seneca misquotes Virgil, who wrote not "by what name" but "with what poetry," that is, "How can I praise you highly enough?"—which makes more sense of the second sentence quoted by Seneca. Falernian was one of the best Italian wines; Rhaetian came from the Alps.

53. The final phrase of the sentence is incurably corrupt in the manuscripts: there have been numerous conjectures, making Seneca say that the cloud resembles the sun, or is close to the sun, or is capable of reflecting the sun, or something similar.

54. See 1.11.2.

55. Aratus was a Greek poet of the fourth to third centuries BCE, whose major work was the *Phaenomena*, a poem about the constellations and weather signs. Parhelia are mentioned at lines 884–86. Aratus's Stoicism is evident in the poem, especially in its treatment of Zeus as the Stoic supreme deity. The poem was very popular in Rome, and by Seneca's time there were Latin versions by Varro of Atax, Cicero, and Germanicus.

56. In modern terms, this paragraph very likely brings together very diverse phenomena: at the start, and in the following paragraph, are meteors and fireballs (already dealt with in 1.1), but "wells," "jars," and "chasms" could possibly be comets (discussed in book 7), or novae, or supernovae, or displays of the northern aurora (which is occasionally visible as far south as Italy).

57. Virgil *G.* 1.367. The same line is quoted (with slightly different word order) at 7.20.1.

58. Greek *sela* means "lights," "flames," another term applied to meteors and other bright objects in the sky.

59. In book 7.

60. See 1.5.14.

61. Criminals could be thrown to the wild beasts: the suggestion is that Hostius is a wild beast himself. There may also be a suggestion of the mytho-

logical Erysichthon, who, when punished by Ceres with insatiable hunger, finally ate himself.

62. Virgil *Ecl.* 2.25–26, spoken by the shepherd Corydon. The second line is quoted at 5.1.1 as well.

63. That is, other, more precious metals.

64. "Fragile" is puzzling; it suggests pottery (but pottery mirrors are not attested) or glass (Parroni [2002] ad loc. refers to Pliny *HN* 36.193), though in the context one might expect a cheaper metal to contrast with silver.

65. Dowries were handed back when there was a divorce.

66. The Latin is here corrupt, and the exact wording cannot be restored with certainty, but again the reference is to the dowry given by the senate.

Book 2 [originally Book 8]

1. Seneca is probably thinking of the question whether the heavens rotate while the earth stands still at the center of the universe (the usual view in antiquity), or the heavens stand still while the earth rotates; see also 7.2.3.

2. Referring to the solstices: before the summer solstice, the sun ascends higher in the sky each day; at the solstice it "turns back" and reaches a lower height each day; the opposite happens at the winter solstice.

3. Ovid *Met.* 1.55.

4. "High up" represents the Greek *meteora*, the subject matter of meteorology (see the introduction).

5. The Stoics and others sometimes regarded the earth as a living creature; Seneca has developed the idea at 3.15 and 6.14.

6. "Matter" here covers both "subject matter" and "physical matter."

7. On the Stoic theory of continuity and composite bodies, see LS, 1:170, 280–94.

8. See 5.8.1.

9. The atomists.

10. A reference to the water organ, which used a hydraulic system to maintain a constant air pressure.

11. The atomists again.

12. Seneca does not return to the topic in the surviving books; but in any case, this is a standard kind of transitional formula that need not constitute a firm promise to return to the topic. The theory of antiperistasis is found in Plato (*Ti.* 79a5–80c8, where it is called *periôsis*), and may go back to the Presocratics. Lucretius argued against it (1.370–97).

13. This is a brief statement of the argument for the existence of "self-moved movers," first found in Plato *Phdr.* 245c–246a, and *Leg.* 10, 894b ff.

14. Seneca could be drawing on the Stoic doctrine of "total blending," *krasis*

di' olôn, the complete interpenetration of two substances in a mixture (see LS, 1:288–94); or he may simply regard walls and so on as porous to air.

15. See 2.1.1.

16. This refers to the motion of the planets, which, in the ancient geocentric system, seemed to travel through the zodiac from west to east at the same time as being carried round with the heavens and fixed stars from east to west.

17. Lightning-bolts, *fulmina*, are, in modern terms, cloud-to-ground lightning, and lightning-flashes, *fulgura*, are intracloud, or sheet lightning.

18. DK59A84. See 4a.2.17.

19. Aristotle *Mete.* 2.9, 369a10–14, 25–b11.

20. Two standard pieces of Roman artillery.

21. DK13A17. See 6.10.1.

22. Greek philosopher of the sixth century BCE; see DK12A23.

23. The process of "rushing together again" is not paralleled elsewhere in the book. Perhaps it should be emended to "struggling" or "whirling."

24. No philosopher of this name is known; the name has been variously emended to "Anaximander," or "Anaxagoras" (though both of these have already been mentioned in the book), or "Archelaus."

25. DK64A16 = Diogenes T31b Laks. See 4a.2.28.

26. That is, forms a pointed flame.

27. Posidonius frag. 228, T41a Edelstein-Kidd = frag. 324, frag. 329, T21a Theiler. Other sources date this eruption, which produced the island of Hiera in the Santorini bay, to about 197 BCE.

28. In 46 CE.

29. See 5.15.1.

30. Inflated bladders were used as balls.

31. "Properly," because the Latin word *fragor*, translated "crash," is connected with the verb *frangere*, "to break, burst."

32. Cambyses was king of Persia from 530 to 522 BCE.

33. See 2.12.4.

34. See 2.26.1.

35. No other ancient writer alleges that lightning solidifies wine. Seneca returns to the topic at 2.53.

36. It was commonly believed that after a lightning-bolt struck something, it then flew back up into the air again, normally by a different path.

37. Seneca believes in the spontaneous generation of worms in corpses. The phrase can refer both to the bodies of poisonous creatures and to corpses of creatures killed by poison.

38. Seneca presumably refers to written oracles, which were notoriously obscure.

39. On Stoic views of divination and fate, see LS, 1:232–33, 259–66.

40. It was widely held among Stoics and others that god is not concerned with the trivial details of the universe.

41. In Roman augury, omens were not valid unless formally acknowledged by the appropriate person.

42. See 7.4.1.

43. Aspect, in astrology, is the angular relationship between planets or constellations.

44. That is, the type of lightning. The interpretation of this word (*formula*) in the context is uncertain, as are the text and interpretation of the preceding sentence.

45. Seneca refers to the Stoic doctrine of "co-fated" events, where both a result and the cause of that result are fated. See LS, 1:339–40, 389.

46. Aulus Caecina, a public figure and writer of the late Republican period, and a friend of Cicero's. His family was of Etruscan origin.

47. The exact interpretation of these and some other technical terms of Etruscan religion used by Seneca is uncertain.

48. Something is missing (e.g., "by enemies").

49. This Latin word normally means "booty" or "the proceeds of selling booty," senses whose relevance to the kinds of lightning here distinguished is not immediately apparent.

50. In Roman religion the twelve (chief) gods were Jupiter, Juno, Neptune, Minerva, Mars, Venus, Apollo, Diana, Vulcan, Vesta, Mercury, and Ceres.

51. Nothing more is known for certain about these deities.

52. Ovid *Met*. 3.305–7.

53. A reference to cult statues.

54. See 1.praef.3.

55. A Stoic philosopher in the early principate, one of Seneca's philosophical mentors.

56. If the Latin word *dentanea* is correct, it is obscure, though it presumably is related to *dens*, "tooth," or "prong"; it should be perhaps be corrected to *ostentanea*, "ostensible."

57. The manuscripts have the unintelligible *atertanea*. Thulin suggested *opertanea*, "concealed," or "secret."

58. The Latin is probably either imprecise or corrupt, for Seneca probably refers to sacrifices used to call down lightning, and Jupiter with it.

59. See 2.31.1.

60. At the start of this chapter.

61. See 2.31.1 and note 35.

62. Posidonius frag. 135 Edelstein-Kidd = 325 Theiler. Although Seneca has mentioned Posidonius earlier (2.26.4), he has not previously referred to his views about thunder and lightning.

63. A philosopher of disputed date, either late fifth or fourth century BCE.

Some identify him with the Atthidographer Clidemus. See DK62.1; *FGH*, 323F31.

64. Greek philosopher of the sixth to fifth centuries BCE; see DK, 1:492.6–8.

65. *Fulgetrum* (or the feminine *fulgetra*) is indeed found mainly in earlier writers, as is *fulgĕre*. *Tonus* is not otherwise attested in the sense "thunder"; *tonitrua* was a more recent form, but Seneca is misleading in implying that *tonitrus* was no longer in use, for he occasionally uses the form himself.

66. See 2.40.1–2.

67. In Roman religion there were rituals to be performed at any spot struck by lightning, including sacrifices and the burial of the lightning-bolt (sometimes, perhaps, what we call a meteorite).

68. See 6.1.6.

References

Recent Editions of the Latin Text

Codoñer Merino, C., ed., trans. 1979. *L. Annaei Senecae, "Naturales quaestiones."* 2 vols. Colección hispánica de autores griegos y latinos. Madrid: Consejo Superior de Investigaciones Científicas.

Hine, H. M., ed. 1996. *L. Annaei Senecae "Naturalium quaestionum" libri*. Bibliotheca Scriptorum Graecorum et Romanorum Teubneriana. Stuttgart: B. G. Teubner.

Parroni, P., ed., trans. 2002. *Seneca, "Ricerche sulla natura."* Scrittori Greci e Latini. Milan: Fondazione Lorenzo Valla/Arnoldo Mondadori Editore.

Vottero, D., ed., trans. 1989. *Seneca, "Questioni naturali."* Classici latini UTET. Turin: Unione Tipografico-Editrice Torinese.

(Vottero's and Parroni's editions both contain detailed notes in Italian.)

Books and Articles

This bibliography concentrates on work in English. Berno and Gauly give extensive recent bibliographies.

Berno, F. R. 2003. *Lo specchio, il vizio e la virtù: Studio sulle "Naturales Quaestiones" di Seneca*. Bologna: Pàtron.

Freeland, C. A. 1990. "Scientific Explanation and Empirical Data in Aristotle's *Meteorology*." *Oxford Studies in Ancient Philosophy* 8:67–102.

Gauly, B. 2004. *Senecas "Naturales Quaestiones": Naturphilosophie für die römische Kaiserzeit*. Zetemata 122. Munich: C. H. Beck.

Griffin, M. 1992. *Seneca: A Philosopher in Politics*. 2nd ed., enlarged. Oxford: Clarendon Press. (Orig. pub. 1976.)

Gross, N. 1989. *Senecas "Naturales Quaestiones": Komposition, naturphilosophische Aussagen und ihre Quellen*. Palingenesia 27. Wiesbaden: Franz Steiner.

Hall, J. J. 1977. "Seneca as a Source for Earlier Thought (Especially Meteorology)." *Classical Quarterly* 27, no. 2:409–36.

Hine, H. M. 1981. *An Edition with Commentary of Seneca, "Natural Questions," Book Two*. New York: Arno Press.

———. 2006. "Rome, the Cosmos, and the Emperor in Seneca's *Natural Questions*." *Journal of Roman Studies* 96:42–72.

———. 2009. "Seneca's *Naturales Quaestiones* 1960–2005 (Part 1)." *Lustrum* 51:253–329.

———. Forthcoming, 2010. "Seneca's *Naturales Quaestiones* 1960–2005 (Part 2)—with Addenda covering 2006." *Lustrum* 52:7–160.

Hutchinson, G. O. 1993. *Latin Literature from Seneca to Juvenal: A Critical Study*. Oxford: Clarendon Press.

Inwood, B. 1992. "God and Human Knowledge in Seneca's *Natural Questions*." In *Traditions of Theology: Studies in Hellenistic Theology, Its Background and Aftermath*, ed. D. Frede and A. Laks, 119–57. Philosophia Antiqua 89. Leiden: Brill. Reprinted in Inwood 2005, 157–200.

———. 2005. *Reading Seneca: Stoic Philosophy at Rome*. Oxford: Clarendon Press.

Kidd, I. G. 1988. *Posidonius*. Vol. 2. *The Commentary*. 2 vols. Cambridge: Cambridge University Press.

Leitão, D. D. 1998. "Senecan Catoptrics and the Passion of Hostius Quadra (Sen. Nat. 1)." *Materiali e Discussioni* 41:127–60.

Rosenmeyer, T. G. 2000. "Seneca and Nature." *Arethusa* 33, no. 1:99–119.

Scott, J. 1999. "The Ethics of the Physics in Seneca's *Natural Questions*." *Classical Bulletin* 75, no. 1:55–68.

Setaioli, A. 1988. *Seneca e i Greci: Citazioni e traduzioni nelle opere filosofiche*. Bologna: Pàtron.

Sørensen, V. 1984. *Seneca: The Humanist at the Court of Nero*. Trans. W. G. Jones. Edinburgh: Canongate.

Stahl, W. H. 1962. *Roman Science: Origins, Development, and Influence to the Later Middle Ages*. Madison: University of Wisconsin Press.

Taub, L. 2003. *Ancient Meteorology*. London: Routledge.

Williams, G. 2005a. "Interactions: Physics, Morality, and Narrative in Seneca *Natural Questions* 1." *Classical Philology* 100, no. 2:142–65.

———. 2005b. "Seneca on Winds: The Art of Anemology in *Natural Questions* 5." *American Journal of Philology* 126, no. 3:417–50.

———. 2006. "Greco-Roman Seismology and Seneca on Earthquakes in *Natural Questions* 6." *Journal of Roman Studies* 96:124–46.

———. 2007. "Seneca on Comets and Ancient Cometary Theory in *Natural Questions* 7." *Ramus* 36, no. 2: 97–117.

———. 2008a. "Reading the Waters: Seneca on the Nile in *Natural Questions*, Book 4A." *Classical Quarterly* 58, no. 1:218–42.

———. 2008b. "Cold Science: Seneca on Hail and Snow in *Natural Questions* 4B." *Cambridge Classical Journal (Proceedings of the Cambridge Philological Society)* 54:209–36.

Index