Albert the Great
On the Causes of the Properties of the Elements.
Trans. Irven M. Resnick.
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Scholastic natural philosophy, the philosophical understanding of nature based upon Aristotle's extensive writings on physics, biology, geology, and astronomy, is of interest to us in two ways. First, there are philosophical arguments and insights of perennial value. The understanding of form and matter, of what it means to be an element, of what it means to be alive, of causality, and so forth are philosophically as important today as they were in antiquity or the middle ages. Whether one accepts or rejects Aristotle, the Aristotelian position is still a philosophical option, and this is so in natural philosophy no less than in ethics or epistemology. Second, one might have an historical interest in the empirical explanations, often somewhat fanciful, and sometimes surprisingly correct, that the ancient or mediaeval naturalists gave of natural phenomena. What causes volcanoes or floods or the motion of the tides? What is the behavior of animals or the effect of various herbs or medicines? Explanations of such phenomena are almost always, from our vantage point, insufficiently grounded in empirical data, and they are often wrong. It is, however, historically important to know how educated people in the past understood the natural world. The small volume under review here is of interest to us in both of these ways, but more in the second (historical) way than in the first (philosophical) way.

Albert the Great (1200-1280) claims our attention for several reasons: he was the first of the scholastic philosophers to assimilate and to re-present (in the form of Latin paraphrases of the original works) the whole of Aristotle's philosophy; he was a strong advocate of the study of nature who, like Aristotle himself, was a naturalist and an observer of nature, insistent on empirical verification for claims about nature; and he was the teacher of Thomas Aquinas. *On the Causes of the Properties of Elements* is an example of Albert's assimilation and re-presentation of Aristotle's natural philosophy, or would be such, if the work in question were a paraphrase of a genuine work of Aristotle. In fact, however, in this instance, Albert has written a paraphrase of a pseudo-Aristotelian work: a work written in Arabic, probably in the 9th century, and translated into Latin by Gerard of Cremona in the late 12th century. This work, which had the Latin title of *De causis proprietatum elementorum*, was widely read in the 13th and 14th centuries (there are 127 extant manuscripts—a large number), but Albert was the only scholastic philosopher to have written a dedicated commentary on this work. The work is an exposition of the ancient doctrine of the four sublunary elements—earth, water, air, and fire—and also of the fifth element, aether, that makes up the heavenly spheres. Albert's paraphrase of this work, which is translated here, represents broadly the Aristotelian tradition but not an actual work of Aristotle.

The elements were understood to have inherent natural properties: each is either heavy or light, either hot or cold, and either wet or dry. They are almost never found in their pure state; rather, each one will be found insofar as its *properties* are found in some compound or living substance. Even the water that we drink and the air that we breathe are not instances of pure elements; they are compounds that are dominated by the obvious element but that also contain important traces of the other elements. The four elements are thus the basic chemistry of natural things in our world, but the heavenly bodies are also influential on natural events and substances, and the composition and causal influence of the moon, sun, planets, and stars must also be understood. Since these bodies cannot be generated or destroyed, they cannot be of the same stuff as things down here that are always being brought into and out of existence. They are composed of the fifth element (the Quintessence) or the first body, which Aristotle calls aether, and they move locally but they do not undergo any other sort of change. The moon, for example, exerts an influence on water, causing, among other things, the tidal motions.

Let us consider two examples of Albert's reasoning as a naturalist. First, Albert offers a lengthy (five chapters) explanation of tidal motion which, as I have just mentioned, he correctly understood to be caused in large part by the moon. Albert did not think that the moon was the sole cause of tidal motion, because he noted a number of other relevant causes: the shape, location, depth, and quality of the relevant sea basin; the presence or absence of winds, currents, and swells; the 'quality' of the water (salty or fresh, stagnant or moving, contaminated or not); and the possible conjunction of other heavenly bodies with the moon. In all of this, although Albert does not provide a novel explanation, he argues from empirical evidence and he gives causes and factors that we would recognize as genuine. In doing so, Albert came closer to the truth of the matter than would Galileo more than 350 years later, who thought that the tides were an additive product of two motions, the earth's diurnal rotation and the yearly orbit around the sun. Albert, of course, did not understand gravitational motion as we do, and he therefore mistakenly attributed the moon's influence on the motion of water as being caused by the light from the moon. In this I think that one might fault Albert's empiricism, because one should expect a weaker influence of a crescent moon as compared with a full moon, but in fact we do not observe such a difference. Albert does refute two received but wrong positions: that the tides are caused by the basic diurnal east-to-west motion of the prime mover (which is wrong because tides are much more irregular than such a cause would produce), and that tides are the product of something like the 'breathing' in the sea, as though it were alive (which is wrong because tidal motion is less regular than breathing and because the empirical evidence for its connection to the moon is strong).

Second, Albert argues against the venerable but completely unfounded theory of the 'music of the spheres'. The notion behind this theory is that anything whirling around us as big and as fast as the sun, moon, planets, and stars must be making a sound. If I swing a rope with a weight attached to its end over my head, I will hear a whirring sound;

surely the heavenly bodies must be making a similar sound, in fact, many such sounds, producing the 'music of the spheres'. We do not hear these sounds, so the theory goes, because they are a constant background noise that we are incapable of noticing—elevator musak for the whole universe, but less irritating. Albert argues against this theory, however, by pointing out that, in fact, the sound produced by the heavenly bodies could not be a *constant* sound, because the heavenly bodies are not at a uniform distance relative to our position on the Earth. The sun, for example, is nearer to us at noon than it is at sunrise or at sunset. The same is true for the moon, the planets and the stars. If this is so, and if these bodies are producing sounds, then it must be the case that the sounds they produce vary in intensity and in pitch. But if the sounds are varied, then they cannot be a constant background noise that we would not notice. In fact, we do not hear music from the spheres because there is no music to be heard. Arguments for non-existence can be tricky, but Albert's point is that the burden of proof is on those who claim the existence of such sounds and that their arguments are faulty. He shows that the case, as given, is not proven.

In order to drive home the point about the relative distances of the heavenly bodies from our location on Earth, Albert gives a geometrical demonstration that, in the Cologne Latin edition from which this translation is made, is accompanied by a diagram. Unfortunately, the reproduction of that same diagram in this translation is distorted in such a way that the diagram appears to show the opposite of what Albert's demonstration is intended to show.

Professor Irven Resnick has done an excellent job of translating, introducing, and annotating this work. Albert is given to using rather cumbersome Latin constructions that are hard to render into readable English. Resnick has produced a translation that is both readable and accurate—a very commendable scholarly achievement. His introduction provides the textual background to the text of Albert and to the pseudo-Aristotelian text that forms the basis of this work, and the notes provide helpful references to Albert's sources. Where necessary, Resnick provides explanatory footnotes for obscure doctrines and terms. For anyone with an interest in this important area of mediaeval natural philosophy but without Latin, I would recommend this translation with enthusiasm.

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