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Christoph Sander, 2020. *Magnes. Der Magnetstein und der Magnetismus in den Wissenschaften der Frühen Neuzeit*, Leiden-Boston, Brill, 1140 pp.

Magnes. Der Magnetstein und der Magnetismus in den Wissenschaften der Frühen Neuzeit by Christoph Sander is at once an in-depth and an extensive examination of the emergence of a ‘science of magnetism’ (*Magnetwissenschaft*) which had its culmination in the early modern age. The book analyses how such a science was shaped in nine main thematic and disciplinary areas, each one treated in a separate chapter (chapters 1-9), while chapter ten provides a final discussion of the emergence of a *Magnetwissenschaft* as an actor’s category in the seventeenth century, and a selection of the foremost sources is given in an *Appendix*. The chapters are fairly independent of each other, allowing the reader to easily gather specific insights on the different perspectives in which magnetism was treated. In turn, the connections between the chapters can be appreciated through the inter-thematic and inter-disciplinary ramifications highlighted by the author, such as in the case of the discussion of the antipathy between magnet and garlic, a lively topic across the various discussions of magnetism. Moreover, the author has wisely chosen – instead of reconstructing the whole historical development of the different ways in which magnetism was discussed – to focus in each chapter on a selection of sources exemplifying the particular moments of change in conceiving magnets and magnetism across history. The span of time considered by the author, indeed, is not only the early modern age, but also includes ancient and medieval sources, both European and Arabic.

This does not mean that each chapter is just thematically or disciplinarily oriented: indeed, different chapters provide a discussion of the topic of magnetism at different levels of analysis. Thus, in chapter one the author focuses on the most fundamental ideas or meta-concepts guiding the treatment of magnetism in history, such as found in etymology, typology, aspect, effects, uses of magnets, systematically considering the place in which such ideas were developed: namely lapidaries and natural histories, with particular attention to Plinius’s *Naturalis historia*, Isidore of Seville’s *Etymologiae*, up to Ulisse Aldrovandi’s *Musaeum metallicum* (1648). In turn, chapter two is devoted to the analysis of the issue of the mineralogical classifications of magnets according to various criteria (such as their phenomena and effects), across a number of authors (such as William Gilbert, Andreas Libavius, Gabriele Falloppio, Georg Agricola), detailing the foremost differentiation between stones and metals. Moreover, it considers how thinkers such as Paracelsus and Robert Fludd discussed their properties in the light of alchemical principles, touching also upon the handling of magnetism in pharmacology and astrology, and showing how this led to the linking of mineralogy and astrology in the early modern age, as well as to the establishment of a universal idea of magnetism.

Deepening the level of analysis, in chapter three the author focuses on the ways the idea of magnetism was used in the development of theories of the Earth, by exploring first the discussions on mining techniques (with special attention to German sources) and metallurgy (focusing on Petrus Peregrinus, Leonardo Garzoni and Agricola), and then on the treatment of the magnetism of the Earth by Gilbert, Niccolò Cabeo, Galileo Galilei, and finally René Descartes in whose hands geomagnetism became a core topic of his broader natural-philosophical theory. Then, chapter four is devoted to the discussion of the idea and uses of magnetism in medicine: the author focuses on the classification of the effects of the magnet given by Bernardo Cesi, putting it in the broader context of the medical treatment of magnetism given by Dioscorides’s *De materia medica* onwards, and reconstructs the various explanations of the medical effects of magnet, considering a bulk of authors from Galen to Giovanni Battista Della Porta and Athanasius Kircher. Moreover, attention is also paid to the use of magnetism in medical analogies, namely in the comparisons of the effects of

magnets with various physiological and pharmacological phenomena, as well as to the all-encompassing use of magnetism in medicine by Paracelsus, who reduced a great variety of phenomena and powers in medicine to magnetism. In chapter five, in turn, the focus is on cosmology, in its broadest sense: that is, the author considers the explanation of magnetism by means of astrological ideas, showing how recourse to the idea of the influence of the stars to explain magnetic powers had, in Marsilio Ficino, Cornelius Agrippa, Petrus Arlensis de Scudalupis and Fludd, its main expounders. Hence, the use of the analogy of magnetism with the effects and movements of celestial bodies is considered, focusing on the uses of magnetism to illustrate the ways in which the stars influence the terrestrial realm, such as in the case of the assumption of the garlic-magnet antipathy by Girolamo Cardano and Jean Baptiste van Helmont. Eventually, the author highlights the ‘magnetization’ of the whole cosmos: namely the interpretation of Earth as a magnet by Gilbert and the subsequent explanation of planetary movement in terms of magnetism by Johannes Kepler.

At this point, the focus is extended from the history of philosophy, science and medicine to that of scientific instruments: in chapter six the author provides a detailed analysis of the uses and theories of the instruments of which a magnetic needle was part, namely the nautical compass, the moveable sundial and the compass used by geographers and land surveyors – with the support of a huge illustrative apparatus. Such instruments are analysed with regard to the discussions about their origins (such as in the supposed invention of the nautical compass by Flavio Gioia) and to the cases of surviving instruments (especially from Italy and Germany). Moreover, the author discusses the principles and characteristics of the movement of the magnetic needle, namely of its declination, inclination and deviation, focusing on how such concepts were present first in illustrations such as maps (as in Peter Apian’s *Cosmographicus liber*) and then discussed by geometrical means (as by Martín Cortés and Gerhard Mercator), and by natural-philosophical theories (as by Gilbert). In chapter seven the discussion of magnetism continues by focusing on other practical aspects of its thematization, namely its uses in magic, that is (in accordance with Della Porta’s considerations) in the very application of natural-philosophical knowledge in practical matters: accordingly, the author focuses on (1) the illustrative and analogical role of magnetism in magic, in order to make comprehensible the work of the magician and to illustrate a certain mode of action relevant in magic or a possible object of knowledge in magic itself: as to these aspects, the author focuses on Della Porta, Kircher, and Cardano; (2) the concrete uses of the magnet in magical practices (for example, amulets or talismans), extending his discussion also to ancient and medieval authors and practices, and (3) on the uses of magnets in machines labelled ‘magical,’ such as amusement devices, the use of magnets in architecture (e.g. in temples), and perpetual motion machines.

In the remaining chapters, the discussion moves to a more general level of consideration, considering philosophy and theology. In chapter eight the author explores the place of magnetism in natural-philosophical discussions, namely the ways in which the powers of the magnet were explained, that is a cause was found for them – in accordance with the Aristotelian standard in explaining a phenomenon. First, the author identifies the magnetic effects to be explained, focusing on early modern discussions of the matter (e.g. Cabeo, Della Porta, Gilbert and Descartes), such effects being those of polarity, attraction and repulsion, modifications of such powers, inclination and deviation, and discusses the explanatory concepts typical both of Aristotle and the early modern Scholastic tradition, shedding light on ideas such as those of *sphaera activitatis* or *contactus*. Here, the author provides a thorough discussion of natural-philosophical theories of magnetism: both Aristotelian and alternative ones (e.g. atomist) across history, and focusing especially on the corpuscular theory of Descartes. Moreover, attention is paid to the uses of the idea of magnetism as part of other natural-philosophical explanations, such as those of light, weight, and impetus. In turn, in chapter nine the analysis is of the use of the idea of the magnet as a theological trope, namely the use of magnetic analogies and examples in Christian theological texts, such as the use of analogy and examples typical of theological considerations, focusing especially on sermons, both in Protestant (as by Johannes Mathesius) and Catholic areas (as by Giulio Cesare Russo and Mario de

Bignoni), and on exegetical texts (as by the Jesuit Luis Alcázar). Moreover, the author discusses the emergence of the so-called 'magnetic theology,' namely the emerging centrality of the use of the magnet analogy in theology through Samuel Ward and Maximilian van der Sandt. Eventually, in chapter 10 the author provides a discussion of the overall emergence of a science of magnetism as a technician's category, exploring the different kinds of works in which such a science emerged, especially through considering Peregrinus's *Epistola de magnete* in the Middle Ages, as well as minor and major works up to the 1650s (such as those of Fernán Pérez de Oliva, Robert Norman, Leonardo Garzoni, Paolo Sarpi, Della Porta, Gilbert, Leone Allacci) – both in print and handwritten.

To sum up, this book is essential for anyone addressing the topic of magnetism in a historical perspective up to the seventeenth century. Its thoroughness justifies its length (1140 pages), while the huge illustrative apparatus, together with the large number of diagrams (addressing and exemplifying from a quantitative standpoint the topics taken into historical consideration), of summaries and sub-chapters, makes it easy to grasp the conceptual structure of the author's analysis, as well as the information brought to light.

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