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Jesuit Geophysical Observatories

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Jesuits have had an interest in observing and explaining geophysical phenomena since this religious order, the Society of Jesus, was founded by Ignatius of Loyola in 1540. Three principal factors contributed to this interest: their educational work in colleges and universities, their missionary endeavors to remote lands where they observed interesting and often as yet undocumented natural phenomena, and a network of communication that brought research of other Jesuits readily to their awareness.

One of the first and most important Jesuit colleges was the Roman College (today the Gregorian University) founded in 1551 in Rome, which served as a model for many other universities throughout the world. By 1572, Christopher Clavius (1537–1612), professor of mathematics at the Roman College, had already initiated an important tradition of Jesuit research by emphasizing applied mathematics and insisting on the need of serious study of mathematics in the program of studies in the humanities. In 1547 he directed a publication of Euclid's work with commentaries, and published several treatises on mathematics, including *Arithmetica Practica* [1585], *Gnomonicae* [1581], and *Geometrica Practica* [1606]. Clavius was also a Copernican and supported his friend Galileo when he announced the discovery of the satellites of Jupiter.

Christopher Schreiner (1575–1650), a colleague of Clavius, installed the first telescope at the Roman College and carried out observations of sun spots. His book, *Rosa Ursina* (1631) includes a careful discussion of sun spots, the Sun's rotation, and observational methods. He was involved in a priority dispute with Galileo over the discovery of sun spots.

Athanasius Kircher (1601–1680), professor of the Roman College, greatly influenced the learned circles of Europe. Kircher was a universal genius who dedicated his interest to many subjects, among them geophysical phenomena and the deciphering of Egyptian hieroglyphics. The greater part of his observations and speculations relative to geophysical phenomena are contained in his two works, *Mundus Subterraneus* [1665] and *De Arte Magnete* [1643]. In the first he proposed a system of fire conductors in the interior of the Earth that linked the volcanos with a central fire and related them with the occurrence of earthquakes; in the second, he collected observations of the magnetic declination throughout the world and speculated on the cause of the Earth's magnetic field.

During the 17th and 18th centuries, Jesuits made observations of meteorological conditions, magnetic declination, earthquakes, volcanic eruptions, and the aurora borealis. Even at this early date, meteorological observations included measurements of atmospheric pressure, temperature, humidity, and rainfall. Written accounts of these observations from the colleges of Lyon, Milan, Siena, and Prague during the 18th century are of particular interest. The occurrence of the aurora borealis visible at low latitudes was of special interest to Jesuit scientists in this age, among them Laurent Beraud (1702–1787), and Joseph Stepling (1716–1778).

Among the Jesuit scientists of this time, special mention must be made of R. J. Boscovich (1711–1787). Boscovich was a pioneer in differential geometry and developed a theory of matter in which atoms are considered as centers of force fields. In 1793 he published a book on the figure of the Earth, *Dissertatio de Telluris Figura*, in which he determined a value of 1/273 for the Earth flattening (difference between polar and equatorial radius of Earth/equatorial radius of Earth), and in 1741 published *De Inaequalitate Gravitatis in Diversis Terrae Locis* on the variations of gravity measurements. Together with another Jesuit, C. Maire, he made observations in 1755 to measure the length of the arc of latitude between Rome and Rimini.

Missionary work took Jesuits to such remote lands as India, China, and the newly discovered America, putting these missionary-explorers in contact with different cultures and natural phenomena seldom observed in Europe. During their long journeys,

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