International Studies in the Philosophy of Science

ISSN: 0269-8595 (Print) 1469-9281 (Online) Journal homepage: http://www.tandfonline.com/loi/cisp20

Knowledge Production in Non-European Spaces of Modernity: The Society of Jesus and the Circulation of Darwinian Ideas in Postcolonial Ecuador, 1860–1890

Ana Sevilla & Elisa Sevilla

To cite this article: Ana Sevilla & Elisa Sevilla (2015) Knowledge Production in Non-European Spaces of Modernity: The Society of Jesus and the Circulation of Darwinian Ideas in Postcolonial Ecuador, 1860–1890, International Studies in the Philosophy of Science, 29:3, 233-250, DOI: 10.1080/02698595.2015.1179036

To link to this article: http://dx.doi.org/10.1080/02698595.2015.1179036

Published online: 21 Jul 2015.

International Studies in the Philosophy of Science, 2015
Vol. 29, No. 3, 233–250, http://dx.doi.org/10.1080/02698595.2015.1179036

Knowledge Production in Non-European Spaces of Modernity: The Society of Jesus and the Circulation of Darwinian Ideas in Postcolonial Ecuador, 1860–1890

Ana Sevilla and Elisa Sevilla

This article is based on a perspective on circulation of knowledge that allows the consideration of science as the result of the encounter between diverse communities. We tell a story that constantly changes places, scales, and cultures in order to stress the importance of networks as an alternative to the centre/periphery trope, which entangles world histories of science. The result is a picture much more complex and intertwined than the one suggested by these simplifying dichotomies. We focus on a case study that illuminates the process of knowledge production in non-European spaces of modernity. The return of the Society of Jesus to the newly independent nation-states of Latin America is the point of departure to analyse the circulation of a specific scientific idea in Ecuador: Darwin's theory of biological evolution through natural selection. The article follows the paths of three different knowledge makers whose encounters are seen as sites of knowledge production: a religious order, a Latin American nation-state, and a Western European Jesuit-scientist.

1. Introduction

> Circulation is different from simple mobility, inasmuch as it implies a double movement of going forth and coming back, which can be repeated indefinitely. In

Ana Sevilla is at the Department of Social Sciences and Humanities, Universidad San Francisco de Quito. Correspondence to: Colegio de Ciencias Sociales y Humanidades, Universidad San Francisco de Quito, Campus Cumbayá, Casilla Postal 17-1200-841, Quito 170901, Ecuador. E-mail: anasevillaperez@gmail.com. Elisa Sevilla is at the Department of History, Pontificia Universidad Católica del Ecuador. Correspondence to: Escuela de Ciencias Históricas, Pontificia Universidad Católica del Ecuador, Av. 12 de octubre 1076 y Roca, Apartado postal 17 01 21 84, Quito, Ecuador. E-mail: mailto:esevilla099@puce.edu.ec

> circulating, things, men and notions often transform themselves. (Markovits, Pouchepadass, and Subrahmanyam 2003, 2–3)

More than a decade ago, James A. Secord (2004) pointed out the importance of studying the circulatory properties of knowledge. A focus on communication provides an important entry to the history of science and, as Secord suggests, such an approach breaks down the artificial difference between popular science and science proper. However, as Kapil Raj (2013, 337) rightly observes, the effects of this process of circulation of knowledge, the 'significance of the situatedness and movement of science', have received little scholarly attention. The 'where' question of the practice of science is often taken for granted. This trend, in what Raj describes as the classic positivist-idealist expression of the history of science, is based on a belief in science as universal knowledge that finds its roots in mathematics and experimental verification. The spread of science does not seem to be worthy of inquiry since you would expect rational minds to accept what is universally true. Any opposition to the spread of science would manifest the resilience of false beliefs and irrational thinking processes.

This scenario allowed for the concepts of Western science and indigenous knowledge to dominate the social studies of science literature. George Basalla's (1967) essay consolidated this dichotomy with the proposition of a three-phase model of the worldwide diffusion of science from its origin in Western Europe to the rest of the world (Basalla 1967). Basalla's model has met severe criticism precisely because it is based on the idea of the universality of science (Lafuente, Elena, and Ortega 1993; Lipphardt and Ludwig 2011; Raj 2013). This model also builds on the assumption of a 'centre/periphery' boundary with knowledge production taking place in only one centre and travelling, unmodified, to peripheral and dependent territories. The various critiques of the diffusionist agenda have led to the questioning of the idea of universal science, of the possibility of linear transfer, and therefore of the very notion of Western science.

Building on Secord's proposition, Raj (2013) suggests a new entry that hopes to overcome the criticisms of the diffusionist model by emphasizing the concept of circulation. The basic insight is that ideas, expertise, and practices move around the world provoking different levels of encounter and interaction. By considering the interactions themselves as locus of knowledge production, Raj's approach acknowledges the centrality of circulation processes. Science should not be understood as an assembly of 'free-floating ideas', but as a system of knowledge production where practices, instruments, techniques, and services play a critical role. Furthermore, circulation should not be understood as the 'dissemination', 'transmission', or 'communication' of ideas, but as a process of 'encounter, power and resistance, negotiation and reconfiguration' that occurs in cross-cultural interactions (Raj 2013, 343).

Positioning circulation itself as a site of knowledge production is a major shift from a more traditional assumption that usually separates three distinct moments in the making of knowledge: the collection of information, the accumulation and processing, and finally its spread and eventual universal acceptance. As Raj stresses, it is precisely the '*mutable* nature of knowledge makers themselves, as much as the knowledges and

skills that they embody, their transformations and reconfigurations in the course of their geographical and social displacements, that the focus on circulation helps bring to the fore' (Raj 2013, 345). This position has the potential of replacing the inquiry of why Western science has become historically dominant with a more general question about the construction and reconfiguration of knowledge through its circulation processes.

In this article, we will focus on Raj's entry to the history of science in order to analyse a specific case. We are interested in processes of knowledge production in non-European spaces of modernity. Our point of departure will be 1859, the year when Darwin publishes his *On the Origin of Species* (Darwin 1859). This moment somehow links together the three 'knowledge makers' and their encounters we will describe: a religious order, a Latin American nation-state, and a Western European Jesuit-scientist.

2. A Religious Order: The Society of Jesus

By the time Charles Darwin published *On the Origin of Species*, the total number of Jesuits had risen to more than 2000 individuals. This is a staggering number since the Society of Jesus was completely disarticulated after its suppression in 1776:[1] when the religious order was re-established in 1814 it had only eight active members (ARSI [1814] 1970). The subsequent revival and expansion of the Jesuits across the world is crucial to understanding modern Catholicism (McGreevy 2010) and its relation to the circulation of scientific ideas in cross-cultural scenarios. By the end of the nineteenth century the Society was composed of almost 10,000 members distributed around the world (ARSI [1814] 1970). Clearly, the Jesuit order had been able to move from the margins of Catholic life to its centre once again. As was the case for the Society of Jesus before its suppression, the most important observation to make about nineteenth-century Jesuitism was its global orientation.[2]

Father General Jan Roothaan, who directed the new Society from 1829 to 1853, led a successful expansion strategy outside Europe and Jesuits were once again sent to the far-flung corners of the world. This growing development continued under Father General Peter Beckx's direction between 1853 and 1887. The question that remains puzzling is whether the new Society was able to regain its importance in the scientific sphere and as an actor of knowledge production and circulation.

As Agustín Udías (2001) points out, the early scientific work of Jesuits and their contribution to the establishment of modern science have received considerable academic attention.[3] The scientific work of Jesuits in the nineteenth century is less well known. An exception to this tendency is an article written in the 1950s by the director of the Vatican Observatory, the English Jesuit Daniel O'Connell (1956), who describes the contributions of the Society of Jesus after 1814 to astronomy and seismology. Another author who analyses nineteenth-century Jesuit science is Maurice Whitehead (1986), who focuses on the changes of the curriculum of St. Francis Xavier's College in Liverpool, the first British manifestation of the resurgence of Jesuit day schools

throughout nineteenth-century Europe. Udías (2003) describes the history of Jesuit observatories as an important part of the Jesuit scientific tradition.

Despite this limited bibliography on the phenomenon of Jesuit science in the Society after the re-establishment of the order in 1814, the lives and works of three Jesuit-scientists have received considerable scholarly attention. The first is the Italian astronomer Father Angelo Secchi (1818–1878), who is recognized as a pioneer in the study of solar physics (Robitaille 2011) and stellar spectroscopy. He was the director of the observatory and the Chair of Astronomy at the Collegio Romano for 28 years (1850–1878). He was also the second Jesuit to become a Fellow of the Royal Society, in 1856.[4] Secchi was the author of 700 publications (Brück 1979). Massimo Mazzotti (2000) describes one of Secchi's many tensions, being both a scientist and Pope Pius IX's protégé; an apparent paradox. The second Jesuit-scientist who has received scholarly attention is the English astronomer Stephen Perry (1833–1889), director of Stonyhurst College Observatory (Great Britain). He was also elected Fellow of the Royal Society in 1874, the third Jesuit to earn this honour. Perry worked on many aspects of astronomy and geophysics and led several scientific expeditions, especially one to the Kerguelen Islands to observe the transit of Venus (Hingley 2005). Finally, the third Jesuit-scientist whose life and work have been studied is the German Jesuit evolutionist Erich Wasmann (1859–1931). R. Stumper (1954) talks about Wasmann's importance for the understanding of social insects. John R. Betts (1859), Heike Barantzke (1999), and A. J. Lustig (2002) mention Wasmann as an example of the contradictions and tensions of Darwinism and Catholic thought in the nineteenth century. Robert J. Richards (2008) describes his disputes over evolution with Ernst Haeckel. Martina Kölbl-Ebert (2010) analyses how Wasmann had to relate scientific data to a religious conviction in a period of conflict between the Catholic Church and secular society in Germany.

The question to be posed here is if there existed a Jesuit scientific tradition in the nineteenth century or if there were individual efforts to contribute to contemporary scientific debates. Carl-Henry Geschwind (1998, 28) claims that, by the nineteenth century, the earlier Jesuit scientific tradition had faded. Udías (2003, 9), on the other hand, considers that precisely because of the fact that science during the nineteenth and early twentieth century was a field considered as alien and even hostile to religious faith, Jesuits felt the responsibility to engage in science. This apparent contradiction has to do with an aspect of the Jesuit mentality pointed out by Udías: the preference of Jesuits to work among those outside the Church and with frontier subjects. According to Udías's argument, 'the scientific community became the parish of the Jesuit scientist' (Udías 2003, 9). Ecuadorean historiography, in turn, shows that members of the Society of Jesus played a determinant role in the development of a scientific culture in this country. Is this a manifestation of an institutional scientific tradition? Does it have to do with the character and interests of individual members of the Society and a state-led campaign towards the development of science?

Father Beckx's Generalate is crucial for addressing this problem. He modernized the *Ratio Studiorum*, the document that established the global system of education of the Society, giving more room to science subjects in Jesuit education and encouraging

the discussion of modern philosophers (Whitehead 1986). He encouraged intellectual work and promoted the establishment of several journals like *La Civiltà Cattolica* (Italy, 1850), *The Month* (London, 1864), *Etudes* (Paris, 1865), *Stimmen aus Maria-laach* (Germany, 1865), and others in Ireland, Poland, and Belgium (Whitehead 1986).

One specific initiative in Father Beckx's Generalate is of interest to our discussion, that is, the reaction of the Jesuit order to Darwin's theory of evolution by natural selection (Cuvi, Sevilla, and Sevilla 2015). In fact, filled with concern over the pervasive theories of Darwin, the Provincial of the Jesuit order in Germany, Father Anton Anderledy (1819–1892), convinced the Superior General to send every year the most talented young Jesuits to study science at the secular University of Bonn. He hoped to find, through the study of science, the weapons necessary to fight Darwinism (Schade 1925). According to Theodor Wolf (1841–1924), one of these talented young Jesuits who attended the University of Bonn, Anderledy felt that research-based materialism and atheism had to be fought mainly by acute Jesuit naturalists. He understood that the training of teachers and writers had become increasingly necessary for the order and that this would be possible only by applying modern methods and resources. Even though there was a resistance from some of the older professors of philosophy and theology, who claimed that it would be too dangerous to expose young Jesuits to such a liberal environment, Anderledy's 'experiment', as Wolf ([1909] 1910) described it, was approved by the Superior General and he managed to send three young students to Bonn in 1862. Curiously, a few years later, two of the three prominent young Jesuit-scientists were sent to Ecuador to start a Polytechnic school. Their story provides a window for understanding processes of circulation of knowledge and reconfiguration of science in postcolonial contexts.

3. A Latin American Nation-state: Ecuador

By the time Charles Darwin published *On the Origin of Species*, the newly formed Latin American nation-states had only 20 years of history as independent political entities. By 1859, the Republic of Ecuador, one of these young nation-states, had had seven presidents who had fallen from power every two and a half years on average. In Ecuadorean historiography, 1859 is a crucial date because it represents a critical moment when the nation-state almost disintegrated in favour of regional powers (Guayaquil, Quito, and Cuenca) and territorial ambitions of neighbouring Peru. In this conflictive scenario, the European path defined as 'modernity' resonated in the mind of many Latin American politicians. Gabriel García Moreno (1821–1875), a political and intellectual figure that dominated Ecuadorean politics between 1858 and 1875, had a plan on how to move towards what he considered modernity, avoiding the 'liberal menace' coming from neighbouring Nueva Granada, nowadays Colombia. Being at the same time a devout Catholic and a man of science, his nation-building experiment of 'Catholic modernity' (Maiguaschca 1994, 2005; Williams, 2007) understood religious morality to be the basis of national unity and genuine and lasting progress (Demélas and Saint-Geours 1988).

García Moreno based his strategy largely on education. He intended to give impulse to what he considered to be an imperfect and decaying system of public instruction, where the Jesuits would play a crucial role (García Moreno 1862, 12 April). The president was not only looking for religious educators, but sought to plant the seeds of modern science in Ecuador. Science, a totem of modernity, was seen as an instrument of government and administration of the newly independent countries. In 1857, the National Congress approved a law stating that the teaching of science was a mandatory element for the progress of the Republic. This law defined the relationship between science and the Ecuadorean State (Miranda 1972, 30–31). The State became the main promoter of scientific research and actively encouraged European scientists to come to Ecuador and become part of its nation-building project (Sevilla 2013).

The President's political strategy was a very controversial one. The Jesuits had a long history in the Americas and many considered them as the absolute opposite of progress. Nineteenth-century politics dealt mostly with the relationship between Church and the State, and between religion and modernity (Ayala Mora 2011). Liberalism, born from the French, English, American, and Spanish American revolutions, put forward the discussion about secularization. The political and educational role of the Church and the religious orders were questioned by liberal sectors of society (Montalvo 1874). To liberal and anticlerical critics, Jesuits appeared as the chief protagonists of an obsolete, unenlightened, and hierarchical order. A binary opposition between the darkness of Jesuitism and the lights of Enlightenment and science depicted the relationship between this old order and a secularized modernity (Kaiser 2003, 73).

The correspondence between President García Moreno and Father Beckx, the Superior General of the Jesuit order, reveals the complex negotiations that took place. García Moreno proposed three things to the Society of Jesus: he hoped that the Jesuits would manage education in schools, he wanted them to start a mission in the Amazon jungle to evangelize and thus integrate local populations into the nation, and he also wanted them to run a Polytechnic University. The letters convey a sense of frustration:

> I'm tired of waiting, and after a year and a half I have not got over that disappointment. It seems that the superiors of the Order are inspired more by fear than by the desire to do good, and so have seen from afar the situation in Ecuador not as solid and relatively prosperous that it is, but on the edge of an abyss. This motif has prevented them to come to take charge of the schools that I wanted to entrust to them. (García Moreno 1862, 12 April)

After many years of insisting, the Jesuits finally arrived in the 1860s and started teaching in schools all over the country. García Moreno was terribly disappointed with the result. He gave another negative assessment in one of his letters:

> I must add that I am not happy with the Schools as they are. My child, if he were thirteen instead of four, would not go there to waste his time. (García Moreno 1874, 18 July)

Most of the Jesuit priests who first arrived to Ecuador were Spaniards who did not share the same concern for scientific subjects as the president, an element that,

from the beginning, created considerable conflict with the vision of García Moreno (1862, 12 April). In fact, the president's position towards the Society of Jesus changed with the acquaintance of the science-trained German Jesuits sent for the Polytechnic. He realized that for his nation-building plan he did not want just any Jesuits, and he specifically did not want Spanish Jesuits. What he did want was German Jesuits who were much more committed to scientific research and teaching. Actually, German naturalists—whether Jesuit or not—were in high demand across Latin America in the nineteenth century, and they conducted pioneering research across the continent (Lopes and Podgorny 2000). Nevertheless the key point here is that there seemed to exist differentiated 'national styles' of Jesuits.

Yet the administrative organization of the order continued to leave Latin American missions dependent on Spain's Jesuit Province. For the Ecuadorian president, this was a fundamental problem that jeopardized his entire educational project since the Spanish Jesuits did not have the interest or the intellectual preparation to lead the scientific development of his country. He asked for Ecuador to be reassigned either to the French, German, or English Jesuit Provinces or to have a local, independent administration (García Moreno 1874). In fact, he had a decidedly specific definition of the profile of collaborators he hoped to find for his project. He needed religious and scientific men that had the courage to venture into Ecuador's uncharted territory.

On 30 August 1869, during García Moreno's second term, the National Convention issued a decree for the establishment of a Polytechnic University in Quito, the capital of the country (Perez 1921). The decree was based on the assumption that the development of local businesses and industries, the construction of roads, and the improvement of cities and ports would contribute to the progress and happiness of the Republic. For this end, the decree established the urgent need of forming 'men able to perform with skill and brilliance' the public destinations that required fundamental knowledge in mathematics, natural sciences, and engineering applications to solve transport and production problems. The resolution sought to train teachers of science and technology, architects, and civil and mining engineers. The executive branch would deliver, from the national income, the amount of funds necessary to bring a group of qualified teachers from overseas. The instruction would be free of charge (Escuela Politécnica 1871).

Following this decree, the government issued a second invitation to the Society of Jesus (García Moreno 1869a, 9 September; 1869b, 17 February). This time, three young German Jesuit-scientists arrived in Ecuador to run a Polytechnic University. Two of them were Father Anderledy's first 'Bonn experiments': Johannes B. Menten (professor of astronomy and geodesy) and Theodor Wolf (professor of geology and geognosy). On 3 October 1870, classes began. According to the list taken from the registration book, during 1870–1871, 20 students enrolled in mathematics and physics and 8 students in natural sciences. The Polytechnic operated for six years. Between 1870 and 1876, 97 students enrolled in the various courses and 16 additional German Jesuit professors participated. With this large faculty, the range of subjects the school taught was extensive: algebra, trigonometry, geometry, geodesy, astronomy, mechanics, construction of roads and railways, machinery, architecture, physics,

geology, geognosy, crystallography, mineralogy, chemistry, physiology, agriculture, preparation of medicinal substances, pharmacy, toxicology, zoology, Darwinism, botany, natural drawing, topography, French, English, German. Each year, the university published detailed programmes of the courses. A scientific investigation of one of the professors always preceded them (Perez 1921).

The interaction between the Society of Jesus and the Ecuadorean State promoted the circulation of people and ideas. This relationship defined the characteristics of scientific activity in both sides of the equation: Jesuit science and State-sponsored science. The story of Quito's Jesuit-run Polytechnic University is an example that shows the limitations of the diffusionist model and of the centre/periphery trope in two ways: universality and the possibility of linear transfer. First, the type of science that President García Moreno looked for was specific to be considered 'universal'. He wanted a form of science that could support his 'Catholic modernity' project: a version of science that promoted at the same time practical knowledge for his state-building projects and spiritual knowledge for the moral development of his country. Second, the idea of linear transfer does not seem to fit the historical account we have just described. The transfer of knowledge is not linear but rather constantly negotiated, curved, and altered. The most important conclusion we can take out of García Moreno's correspondence with Father Beckx is precisely this frustrating process of long-distance and multi-cultural negotiation, and divergence in interests.

4. A Western European Jesuit-scientist: Theodor Wolf

By the time Charles Darwin published *On the Origin of Species*, Theodor Wolf was an 18-year-old Jesuit in training. He had entered the novitiate of the Jesuit order in Gorheim (Germany) in October 1857. Wolf was part of the project of revival of the Society of Jesus in its global dimension as well as in its involvement in science. His life story is an example of Raj's concept of the mutable nature of knowledge makers. We will follow Wolf in the course of his geographical and social displacements in order to appreciate the importance of circulation in the production of knowledge. Wolf is also an important source for understanding nineteenth-century Jesuit science. His autobiography (Wolf [1909] 1910) gives important information on the Jesuit order's educational approach and scientific interests.

We will quote a section of Wolf's autobiography that is entitled 'Religious Life and Its Abandonment' (1857–1874). The author describes seventeen years of his life that start in Germany with his first years of training as a Jesuit novice and finish in Ecuador with his resignation from the Jesuit order, after what he describes as the final victory of increased internal struggles between belief and knowledge. Wolf's novitiate lasted for two years. The novitiate had a great focus on the teaching of Latin, the universal language of the Society of Jesus. Moreover, most of the time was spent on spiritual matters; this is the teaching of the institutions of the order, the explanation of its rules and customs, religious readings, discipline, deprivation, contempt for the mundane, and so on.

After finishing the novitiate, Wolf spent the first three years of scholasticate in Gorheim, Münster, and Aachen. He affirms that it is during this time that his love for the natural sciences emerges. Contrary to the novitiate, he devoted 17 hours a day (from 4 am to 9 pm) in academic studies and only two to three hours to spiritual matters. To provide guidance about the curriculum, members of the order adhered to the provisions of the *Ratio Studiorum Societatis Jesu*. According to Wolf, this curriculum had been duly adapted to the progress of science. The Jesuit scholasticate was a preparation equivalent to that of the first six years of a college-level school in Germany. The programme included one year of the humanities and three years of rhetorical philosophy (including mathematics, chemistry, and physics). After that the student had either to devote some years in foreign schools or other training centres of the order teaching and educating the young, or to continue his training in a specific field of science. The process would finally end (rarely before the student was 25 or 26 years old) with the study of theology, which lasted four years and ended with ordination.

The crucial element of Wolf's description of the Jesuit method of learning is that, in general, the scholasticate did not follow in any way a fixed plan. Instead, much attention was given to the individual provisions, inclinations, and talents of each student. In additional, the cultivation of scientific abilities was stimulated and active assistance was provided if there was any hope that, for the honour of the order, the student would achieve something important in any field of science. In Wolf's opinion, this characteristic of the Jesuit educational system was the reason why Jesuits had always been able to form leading specialists in different branches of knowledge. He also makes clear that it was this peculiar and sensible system that allowed him to become a naturalist inside the Jesuit order.

In 1862 the Provincial of the Society in Germany, Father Anderledy, summoned him to travel to the secular University of Bonn to study natural sciences. This was a bold move, and an action that stretched the flexibility of the *Ratio Studiorum* to its very limit. In fact some of the older Jesuit professors of philosophy and theology were concerned about the experiment and thought that it would be too dangerous to expose young people to such a liberal environment as the University of Bonn: they feared that the order could easily lose them.[5]

Wolf describes his conversation with Anderledy, who told him that he knew his preferences and scientific aspirations and wanted to give him the opportunity of a sound education in the natural sciences so that, in the future, he may serve the order through them. Anderledy was especially worried about Darwinism, which over the past years had become increasingly popular. He estimated that sharp naturalists should fight materialism and atheism on the basis of scientific research. He had understood that the training of teachers and writers had become increasingly necessary for the order and that this, in some disciplines of modern science, would be possible only by applying modern methods and resources.

Wolf and two other candidates from the Jesuit order were to begin their studies in 1862 at the University of Bonn. Wolf chose as his specialities botany, zoology, and (at the express wish of the provincial) geology, including mineralogy. Of the other two,

one chose chemistry and physics, the other mathematics and astronomy. The three young Jesuits enjoyed complete freedom to choose their classes, dispose of their time, exchange ideas with lay teachers and students, and acquire books and instruments. Wolf concludes that with this freedom of intellectual and physical action, a gradual softening of religious attitudes and customs was inevitable.

The German Jesuit qualifies as a 'strange coincidence' the fact that his university studies happened during a time when a general revolution developed in the investigation of the natural sciences. He is referring to the publication of *On the Origin of Species* in 1859, three years before he joined the University of Bonn. Wolf describes Darwin's revolution as having three major consequences: (a) it overthrew Linnaeus's concept of species, (b) it postulated the evolution of all living things from few original species, and (c) it outlined new directions for botany, zoology, and geology. What many had glimpsed distantly and so few, with deficient evidence, had held openly, had now been proved correct and irrefutable as a result of accurate research: the law of a gradual evolution of all organic nature. Wolf affirms that the theory of descent or evolution was essentially proven and in principle accepted with enthusiasm by the majority of scientists, especially the younger ones, although for several decades there would exist disagreements about the way evolution manifested itself in individual cases. He goes on to say that a lot of phenomena that were considered supernatural and miraculous proved to be natural and necessary consequences of the immutable laws of nature. He concludes that it is understandable that many followers of Darwin's teachings believed that the assumption of the figure of a creator who ran the world would no longer be necessary and it would be easier to live with a pantheistic worldview. But it is equally understandable, for him, that the old struggle between knowledge and belief, between science and orthodox theology, would be stronger than ever. Wolf witnessed this revolution that had such a strong impact on the minds of scientists and laymen. He was also necessarily a participant in it, at first only passively, as an observer, until he clarified his point of view about these debated topics.

Wolf studied at Bonn between October 1862 and the end of the winter term of 1863–1864 (Bonn [1862] 1863). Then he was appointed professor of natural sciences at the Jesuit college in Laach (Germany), were he conducted scientific research for six years (Wolf 1867), between 1864 and 1870. At that moment in his life, and in order to continue his process of Jesuit education, Wolf should have begun his regular studies in theology. He states in his autobiography that he dreaded this transition. He considered his scientific studies and investigations to be his main motivations. He supposed that he would never find himself putting in practice any theological knowledge (e.g. in pastoral care). Similarly, he feared that during the study of orthodox theology, which presupposes a firm faith and the study of the Bible and of ecclesiastical dogma, he would encounter serious internal conflicts with many of his scientific convictions. He felt seriously disturbed and wondered what would become of him with all these doubts.

At this moment something completely unexpected happened that, according to Wolf, helped him forget these doubts for some time: he was appointed professor of mineralogy and geology at the University of Quito in the South American Republic of Ecuador. It is at this point that the three knowledge makers we have described in

this article meet: a religious order, a South American nation-state, and a Western European Jesuit-scientist.

Wolf travelled to South America to take an active part in the project of President García Moreno. He taught at the Polytechnic University for four years (between 1870 and 1874) in charge of various courses in geology, zoology, mining, palaeontology, mineralogy, and Darwinism (Cuvi, Sevilla, and Sevilla 2015). He was also in charge of building a museum of natural history and mineralogy. He travelled extensively around the country, under the president's orders, to gather geological and geographical information of the unexplored territory, and to explain geological phenomena. Every trip was described and published in Spanish in the official newspaper, *El Nacional*, and also published in a slightly modified German version in different European journals.

Over time, Wolf's expeditions around the country found increasing opposition among the more orthodox Jesuits in Ecuador, who considered that Wolf was doing too much science and was too committed to the government. Furthermore, his teachings of Darwinism raised suspicion. One of his former students, Augusto Martínez ([1934] 1994, 259), described Wolf's last lecture on Darwin's theory. According to Martínez's, Wolf lost his patience when he discovered two high dignitaries of the Metropolitan Church standing outside the door of his classroom in a very apprehensive attitude. In an angry voice Wolf asked them either to come in as disciples or to discuss in private the scientific doctrines he was teaching. Without saying a word, the canons covered themselves in their large cloaks, turned, and left. The news that Professor Wolf was teaching anti-Catholic doctrines, according to Martínez, reached the Archbishop of Quito. In fact, even though Wolf was allowed to teach Darwinism in the Jesuit-led Polytechnic School, some members of the order did not approve. Father Federico Aguilar, who ran the astronomical and meteorological observatory before the arrival of the German Johannes Menten, approached President García Moreno to share his concerns about Wolf's teaching of the creation of the world in a way that contradicted religious teachings. The president answered, 'I have brought Dr. Wolf to teach not religion, but Geology' (Destruge [1924] 1982, 314–315).

This growing tension unfolded in 1873 when Wolf wrote a letter to Rome asking for authorization to organize a scientific expedition to the Galapagos Islands, after his local superior denied permission for it because the two German Protestant geologists, Wilhelm Reiss and Alphons Stübel, were going to participate in this same expedition (Wolf [1909] 1910). In Rome, Father Anderledy, Wolf's former promoter in Germany, who had become Assistant of the Father General, in a letter dated 30 May 1873, left the decision in the hands of the Jesuits in Ecuador. Anderledy's letter clarified that permission should not be given if the trip was considered to be harmful to Wolf's religious spirit. He considered Wolf to be a man of strong will but perhaps too addicted to natural history and without an appreciation for philosophy that is truly necessary precisely for those who in our time are devoted to the physical sciences (Miranda 1972). The Spanish Jesuits in Ecuador finally denied permission for the trip to the Galapagos Islands alleging arguments over the negative imbalance between Wolf's spiritual and scientific fervour.

In November 1874, a little over three years after having arrived in Ecuador, Wolf's resignation to the Jesuit order was formalized. In the Jesuit Archives in Rome, there is a reaction from the Superior General Father Beckx to Wolf's desire to leave (Beckx1874a, 18 September). Beckx expressed his concern for Wolf's decision and found no valid reason in Wolf's arguments. He finished the letter hoping that his prayers would be answered and that no matter how hardened Wolf's mind was, he would be able to destroy the illusion that deceived him. Regarding the context around his decision to leave the order, Wolf ([1904] 1911) would describe, years later, in a letter to the German geologist Hans Meyer, that he left under sad conditions to face an uncertain future. He described himself as 'being subject to internal and external hard struggles after having made and executed the decision to break all corporate relations at any price and establish a new and free existence'.

After resigning from the order, Wolf travelled to Guayaquil and, as an independent man, planned his first voyage to the Galapagos Islands. This German ex-Jesuit would become part of a wave of post-Darwinian scientific travel to the islands. Wolf's expeditions to the Galapagos sailed from mainland Ecuador. He made two trips to the Archipelago (August–November 1875 and June–August 1878). In total, he spent six months on the islands—a privileged amount of time considering the scarce 19 days that Darwin ventured on the Galapagos. Wolf's positive reaction to Darwin's ideas not only drove him to travel and investigate in the Archipelago but also shaped the attitude of the local government towards the administration of the islands. He had great interest in the study of geology, botany, and zoology of these islands and his intention was to write a book on them accompanied by maps and plates. Unfortunately, this work was never carried out. More pressing occupations delayed the project of publication, and besides some scattered fragments, published in scientific journals in Europe, his notes and collections were buried under the dust (Wolf 1887, 3). As a result of his explorations, Wolf published six articles specifically related to the natural history and geology of the archipelago (Wolf 1879a, 1879b, 1879c, 1887, 1895a, 1895b). Apart from these publications, Wolf (1892) devoted a chapter of his *Geography and Geology of Ecuador* to the Galapagos region (Sevilla 2013).

What knowledge did Wolf produce? We can argue that he 'produced the Galapagos' for the Ecuadorean government.[6] He created knowledge that would allow the central government to tackle the challenges of incorporating the Archipelago into the nation-state. Wolf was able to produce this knowledge because of the different scientific traditions he built upon and the networks that allowed him to circulate. The Jesuit order introduced him to the scientific method and then to Darwin. Even though it was intended for him to criticize and not praise Darwin's work, it is still the circulation of Wolf within the order's plans and possibilities that stimulated this site of knowledge production. Then the Ecuadorean State promoted his teachings of Darwinism through the Polytechnic University. Finally, on his return from his first trip to the Galapagos, he became state geologist, a privileged position that gave Wolf the authority to define the Ecuadorian territory that until then was considered largely *terra incognita*. He was in charge of producing the first official national map for Ecuador that he published in 1892 (Figure 1; Sevilla 2013).

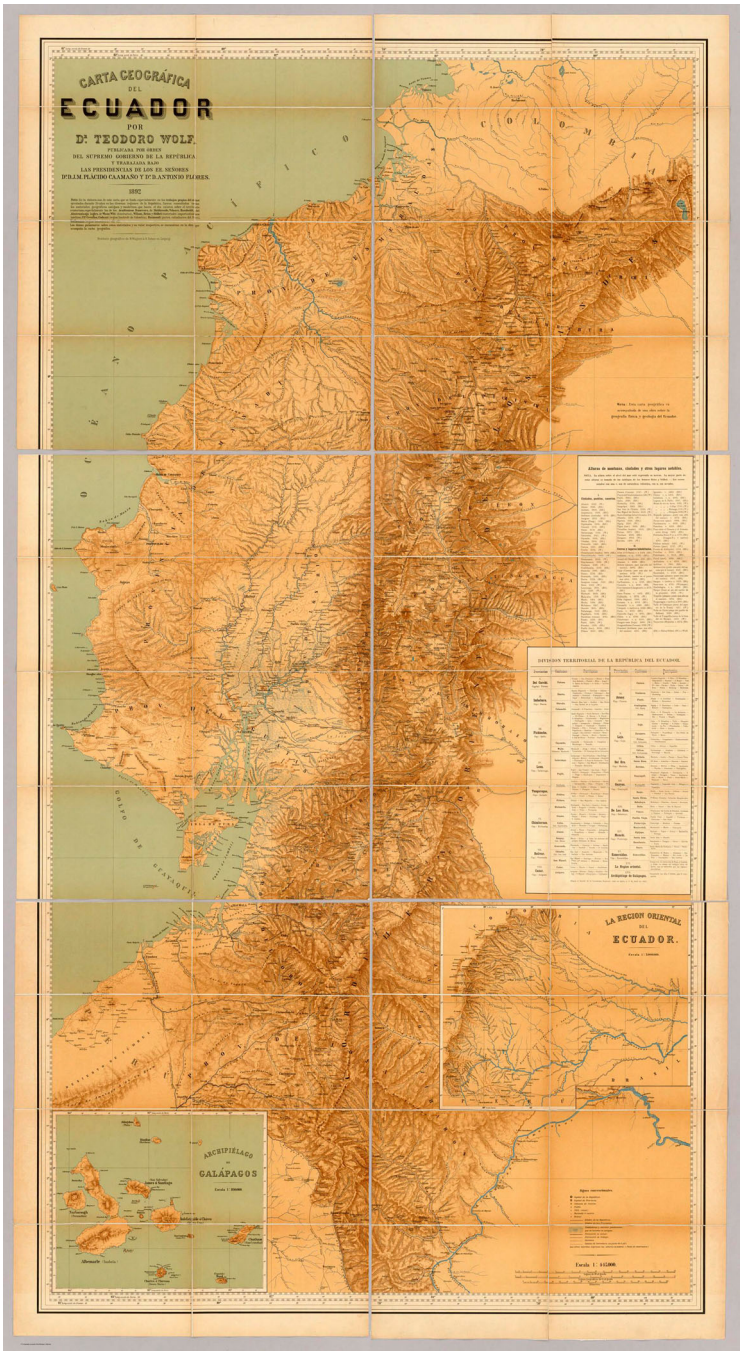

Figure 1. Map of Ecuador by Theodor Wolf (1892). David Rumsey Map Collection, www.davidrumsey.com. Reproduced with permission. *Source*: Wolf (1892).

5. Conclusions

In this article we have focused on a case study that illuminates the process of knowledge production in non-European spaces of modernity. We have studied science in its circulatory and transformative dimension: focusing on the movement of 'scientific skills, practices, materials and ideas and their encounter with the skills, practices, material and ideas of other specialized communities' (Raj 2013, 342). We have argued, following Raj's statement, that these interactions are themselves locus of knowledge construction and reconfiguration.

The term 'circulation' serves as a solid counterpoint to the unidirectionality of concepts like diffusion or binaries like the centre/periphery model. All these notions suggest a producer and a consumer, while circulation suggests a more open-flow process. Nevertheless, as this case shows, the circulation framework also has important limitations: not everything circulates equally smoothly between different cultures, communities, and geographical spaces (Fan 2012). Certain conditions are required for ideas and people to circulate and these circumstances are made possible through long negotiation processes. They depend on patronage, the establishment of specific networks, and the relative power of certain institutions, ideas, and people. For example, Father Anderledy's idea of circulating young Jesuits in a liberal environment such as the University of Bonn was short-lived. As far as we know, only three young Jesuits followed this process. In fact, circulation happens only within limited spaces whose geography changes in the course of history depending on the specificity of the networks and their relative power to interact in a given situation. The mutable nature of these systems of knowledge production is exemplified by the fact that Darwinism circulated, for a specific amount of time, through the Jesuit network, before it received heavy criticism.

Acknowledgements

This research was conducted with a grant from the Government of Ecuador (SENESCYT, 'The Reception of Darwin's Ideas in Ecuador: Theodor Wolf') and the support of two FDA grants from FLACSO Ecuador (IP 553, IP 664). In developing the ideas presented here, we have received helpful input from James McAllister and Nicolás Cuvi. We thank the Archivum Romanun Societatis Iesu for their collaboration in retrieving information on Theodor Wolf and the Polytechnic University. We also thank Ursula Range for allowing us access to the autobiography of Theodor Wolf, and Sylvia van der Made for translating it from German. We also thank Tamara Trownsell, Michael Hill, and the two unnamed referees of *ISPS* for their valuable comments on previous versions of this article.

Notes

[1] The suppression of the Society of Jesus in the late eighteenth century was part of a series of negotiations of secularization during the Enlightenment, involving the strengthening of the Bourbon monarchies through reforms in France, and the Spanish and Portuguese empires

(Venturi 1976). Under Bourbon influence in 1773, Pope Clement XIV signed an edict that dictated the suppression of the Jesuit order.

[2] By the time of its suppression in the late eighteenth century, the Society of Jesus had such a global scientific importance that it accounted for more than 30,000 members and was in charge of more than 85 professorships of mathematics and more than a dozen physical cabinets and directed 25 observatories around the world (Harris 1989, 40–41). In fact, before 1773, the Jesuit order mastered the difficult organizational and administrative tasks required to operate what John Law (1986) and Bruno Latour (1987) have called long-distance networks. Harris (1998) compares the scope of the Jesuit colonial network with that of other legally constituted corporations engaged in overseas activities, such as the East and West Indies trading companies, colonial administrative bureaus, and (eventually) the larger scientific academies capable of launching foreign expeditions. This successful expansion and mobility were largely due to two decisive strategies in the philosophical foundations of the Society in the beginning of the sixteenth century: its focus on education, and specifically, on the education of students who were not members of the Society, and its interest in the overseas missions (Harris 1996, 289).

[3] Jardine (1979); Grant (1984); Dear (1987); Feldhay (1987; 2000); Harris (1989; 1996; 1998; 2005); Gorman (2000); Giard (2005); Núñez Freile (2010); Soto Arango (2010); and Prieto (2011).

[4] The first was Roger J. Boscovich (1711–1787), professor at the Collegio Romano, elected in 1761.

[5] Wolf reflected on this episode and concluded with cynicism: 'from their point of view, these elders were not so wrong!', alluding to the fact that two out of the three 'Bonn experiments' (himself and Johannes B. Menten) resigned from the Jesuit order some years later.

[6] In 1832, the newly formed Ecuadorean State took formal possession of the Galapagos Archipelago (by initiative of General Villamil) and has exercised since then jurisdiction over the islands without interruption and in peace.

References

Unpublished Sources

Archivum Romanum Societatis Iesu, Rome

ARSI. [1814] 1970. Conspectus numericus defunctorum in Societate Iesu. S. L. a. S. i. C. Defunctorum. Archivum Romanum Societatis Iesu.

Beckx, P. 1874a, 18 September. Carta a P. Wolf. *Inventario della Nuova Compagnia. Parte Ia*. Archivum Romanum Societatis Iesu: 332–333.

García Moreno, G. 1862, 12 April. Carta a P. Luis Segura. *Inventario dei documenti inviati alla Curia Generalizia. Parte IIa. Nuova Compagnia (1814–)*. Archivum Romanum Societatis Iesu. Assistencia America Latinae Septentrionalis. Provincia Aequatoriana (Ecuador).

García Moreno, G. 1869a, 9 September. Carta a Padre Beckx. *Inventario dei documenti inviati alla Curia Generalizia. Parte IIa. Nuova Compagnia (1814–)*. Archivum Romanum Societatis Iesu. Assistencia America Latinae Septentrionalis. Provincia Aequatoriana (Ecuador).

García Moreno, G. 1869b, 17 February. Carta a Padre Beckx. *Inventario dei documenti inviati alla Curia Generalizia. Parte IIa. Nuova Compagnia (1814–)*. Archivum Romanum Societatis Iesu. Assistencia America Latinae Septentrionalis. Provincia Aequatoriana (Ecuador).

García Moreno, G. 1874, 18 July. Carta a Padre Beckx. *Inventario dei documenti inviati alla Curia Generalizia. Parte IIa. Nuova Compagnia (1814–)*. Archivum Romanum Societatis Iesu. Assistencia America Latinae Septentrionalis. Provincia Aequatoriana (Ecuador): 3.

Leibniz-Institut für Länderkunde, Leipzig

Wolf, T. [1904] 1911. Cartas a Hans Meyer. *Hans Meyer collection*. Leibniz Institute for Regional Geography. Archive for Geography 179: 367–374: 16 pp.

Archiv der Universität, Rheinische Friedrich-Wilhelms-Universität Bonn

University of Bonn. [1862] 1863. Bonner Personal- und Studentenverzeichnis. *Theodor Wolf*. Rheinische Friedrich-Wilhelms-Universität Bonn. Archiv der Universität.

Ursula Range personal archive, Dresden

Wolf, T. [1909] 1910. *De mi vida: verdad sin ficción*. Translated by Sylvia van der Made. Dresden: Ursula Range personal archive.

Published Sources

Ayala Mora, E. 2011. *Ecuador del siglo XIX. Estado nacional, ejército, iglesia y municipio*. Quito: Corporación Editora Nacional.

Barantzke, H. 1999. "Erich Wasmann (20.5.1859–27.2.1931). Jesuit und Zoologe in Personalunion." *Jahrbuch für Geschichte und Theorie der Biologie* 6: 77–140.

Basalla, G. 1967. "The Spread of Western Science." *Science* 156: 611–622.

Betts, J. R. 1959. "Darwinism, Evolution, and American Catholic Thought, 1860–1900." *Catholic Historical Review* 45: 161–185.

Brück, H. A. 1979. "P. Angelo Secchi, S.J. 1818–1878." In *Spectral Classification of the Future*, edited by M. F. McCarthy, A. G. D. Philip, and G. V. Coyne, 7–20. Vatican City: Vatican Observatory.

Cuvi, N., E. Sevilla, and A. Sevilla. 2015. "Entre Darwin y Dios. Teodoro Wolf y las primeras clases universitarias sobre el origen de las especies dictadas en el Ecuador (1871)." In *'Yammerschuner'. Darwin y la darwinización en Europa y América Latina*, edited by M. Á. Puig-Samper, F. Orrego, R. Ruiz, and J. A. Uribe, 255–278. Madrid: Ediciones Doce Calles.

Darwin, C. 1859. *On the Origin of Species by Means of Natural Selection, or the Preservation of Favoured Races in the Struggle for Life*. London: John Murray.

Dear, P. 1987. "Jesuit Mathematical Science and the Reconstitution of Experience in the Early Seventeenth Century." *Studies in History and Philosophy of Science* 18: 133–175.

Demélas, M.-D., and Y. Saint-Geours. 1988. *Jerusalém y Babilonia. Religión y política en el Ecuador 1780–1880*. Quito: Corporación Editora Nacional.

Destruge, A. [1924] 1982. *Historia de la Prensa de Guayaquil*. Quito: Corporación Editora Nacional.

Escuela Politécnica. 1871. *Programa de las materias que se enseñan en la Escuela Politécnica establecida en Quito el 3 de Octubre de 1870 y aplicación de las mismas a las distintas carreras profesionales, bajo la dirección de los padres de la Compañía de Jesús*. Quito: Imprenta Nacional.

Fan, F. 2012. "The Global Turn in the History of Science." *East Asian Science, Technology and Society* 6: 249–258.

Feldhay, R. 1987. "Knowledge and Salvation in Jesuit Culture." *Science in Context* 1: 195–213.

Feldhay, R. 2000. "The Cultural Field of Jesuit Science." In *The Jesuits: Cultures, Sciences, and the Arts, 1540–1773*, edited by J. W. O'Malley, G. A. Bailey, S. J. Harris, and T. F. Kennedy, 107–130. Toronto: University of Toronto Press.

Geschwind, C.-H. 1998. "Embracing Science and Research: Early Twentieth-century Jesuits and Seismology in the United States." *Isis* 89: 27–49.

Giard, L. 2005. "La actividad científica en la primera Compañía." *Artes Mexico* 82: 8–19.

Gorman, M. 2000. "From 'The Eyes of All' to 'Usefull Quarries in Philosophy and Good Literature': Consuming Jesuit Science, 1600–1665." In *The Jesuits: Cultures, Sciences, and the Arts, 1540–1773*, edited by J. W. O'Malley, G. A. Bailey, S. J. Harris, and T. F. Kennedy, 170–189. Toronto: University of Toronto Press.

Grant, E. 1984. "In Defense of the Earth's Centrality and Immobility: Scholastic Reaction to Copernicanism in the Seventeenth Century." *Transactions of the American Philosophical Society* 74: 1–69.

Harris, S. J. 1989. "Transposing the Merton Thesis: Apostolic Spirituality and the Establishment of the Jesuit Scientific Tradition." *Science in Context* 3: 29–65.

Harris, S. J. 1996. "Confession-building, Long-distance Networks, and the Organization of Jesuit Science." *Early Science and Medicine* 1: 287–318.

Harris, S. J. 1998. "Long-distance Corporations, Big Sciences, and the Geography of Knowledge." *Configurations* 6: 269–304.

Harris, S. J. 2005. "Jesuit Scientific Activity in the Overseas Missions, 1540–1773." *Isis* 96: 71–79.

Hingley, P. D. 2005. "The Priest and the Stuffed Penguin: Father Stephen Perry SJ and the Transit of Venus Expeditions to Kerguelen Island, 1874, and Madagascar, 1882." *Journal of the British Astronomical Association* 115: 150–158.

Jardine, N. 1979. "The Forging of Modern Realism: Clavius and Kepler Against the Sceptics." *Studies in History and Philosophy of Science* 10: 141–173.

Kaiser, W. 2003. "The New Catholicism and the European Culture Wars." In *Culture Wars: Secular–Catholic Conflict in Nineteenth-century Europe*, edited by C. Clark and W. Kaiser, 47–76. Cambridge: Cambridge University Press.

Kölbl-Ebert, M. 2010. "Father Damian Kreichgauer SVD (1859–1940) and Father Erich Wasmann SJ (1859–1931): Geology, Earth History and Evolution in Two German Lives between Science and Faith." *Earth Science History* 29: 311–330.

Lafuente, A., A. Elena, and M. L. Ortega, eds. 1993. *Mundialización de la ciencia y cultura nacional*. Madrid: Doce Calles.

Latour, B. 1987. *Science in Action: How to Follow Scientists and Engineers through Society*. Cambridge, MA: Harvard University Press.

Law, J. 1986. "On the Method of Long-distance Control: Vessels, Navigation, and the Portuguese Route to India." *Sociological Review Monographs* 32: 234–263.

Lipphardt, V., and D. Ludwig. 2011. "Knowledge Transfer and Science Transfer." *EGO: European History Online*. http://ieg-ego.eu/en/threads/theories-and-methods/knowledge-transfer. Accessed November 2011.

Lopes, M. M., and I. Podgorny. 2000. "The Shaping of Latin American Museums of Natural History, 1850–1990." *Osiris* 15: 108–118.

Lustig, A. J. 2002. "Erich Wasmann, Ernst Haeckel, and the Limits of Science." *Theory in Biosciences* 121: 252–259.

Maiguashca, J. 1994. "El proceso de integración nacional en el Ecuador: El rol del poder central, 1830–1895." In *Historia y región en el Ecuador: 1830–1930*, edited by J. Maiguashca, 355–420. Quito: Corporación Editora Nacional.

Maiguashca, J. 2005. "El proyecto Garcíano de modernidad católica republicana en Ecuador, 1830–1875." In *La mirada esquiva. Reflexiones históricas sobre la interacción del estado y la ciudadanía en los Andes (Bolivia, Ecuador y Perú), siglo XIX*, edited by M. Irurozqui, 233–259. Madrid: Consejo Superior de Investigaciones Científicas.

Markovits, C., J. Pouchepadass, and S. Subrahmanyam. 2003. "Introduction: Circulation and Society under Colonial Rule." In *Society and Circulation: Mobile People and Itinerant Cultures in South Asia, 1750–1950*, edited by C. Markovits, J. Pouchepadass, and S. Subrahmanyam, 1–22. Delhi: Permanent Black.

Martínez, A. N. [1934] 1994. "Setenta años de recuerdos: El Dr. Teodoro Wolf." In *Contribuciones para el conocimiento geológico de la región volcánica del Ecuador. Pioneros y precursores del Andinismo Ecuatoriano*, edited by I. Gastaldi, vol. 3, 255–279. Quito: Ediciones Abya Yala y Agrupación de Excursionistas 'Nuevos Horizontes'.

Mazzotti, M. 2000. "For Science and for the Pope-king: Writing the History of the Exact Sciences in Nineteenth-century Rome." *British Journal for the History of Science* 33: 257–282.

McGreevy, J. 2010. "The Jesuit Role in the Emergence of a Catholic Modernity." In *Contending Modernities: A Blog about Catholic, Muslim, and Secular Interaction in the Modern World*. University of Notre Dame. http://blogs.nd.edu/contendingmodernities/2010/12/09/19th-century-jesuits-the-unlikely-emergence-of-a-catholic-modernity/. Accessed October 2012.

Miranda, F. 1972. *La primera escuela politécnica del Ecuador. Estudio histórico e interpretación*. Quito: Fundacion Ecuatoriana de Estudios Sociales, Movimiento Desarrollo y Paz.

Montalvo, J. 1874. *La dictadura perpetua*. Panamá: Tipografía MR.

Núñez Freile, B. 2010. "El pensamiento microbiológico de los jesuitas de la Universidad de San Gregorio Magno en la Real Audiencia de Quito." *Acta Médica Peruana* 27: 65–73.

O'Connell, D. 1956. "Jesuit Men of Science." *Studies: An Irish Quarterly Review* 45: 307–318.

Perez, J. G. 1921. *Recuerdo histórico de la Escuela Politécnica de Quito*. Quito: Prensa Católica.

Prieto, A. I. 2011. *Missionary Scientists: Jesuit Science in Spanish South America, 1570–1810*. Nashville, TN: Vanderbilt University Press.

Raj, K. 2013. "Beyond Postcolonialism . . . and Postpositivism: Circulation and the Global History of Science." *Isis* 104: 337–347.

Richards, R. J. 2008. *The Tragic Sense of Life: Ernst Haeckel and the Struggle over Evolutionary Thought*. Chicago, IL: University of Chicago Press.

Robitaille, P.-M. 2011. "On Solar Granulations, Limb Darkening, and Sunspots: Brief Insights in Remembrance of Father Angelo Secchi." *Progress in Physics* 3: 79–88.

Schade, A. 1925. "Theodor Wolf." *Sitzungsberichte und Abhandlungen der Naturwissenschaftlichen Gesellschaft ISIS Dresden*: 1075–1086.

Secord, J. A. 2004. "Knowledge in Transit." *Isis* 95: 654–672.

Sevilla, A. 2013. *El Ecuador en sus mapas. Estado y nación desde una perspectiva espacial*. Quito: FLACSO.

Soto Arango, D. 2010. "La enseñanza de los 'sistemas del mundo' en las universidades de los jesuitas de Quito y Santafé, siglo XVIII." *Revista Historia de la Educación Latinoamericana* 2: 51–73.

Stumper, R. 1954. "Deux grandes figures de la science des insectes sociaux: E. Wasmann et A. Forel." *Insectes Sociaux* 1: 345–369.

Udías, A. 2001. "Serving God and Science." *Astronomy and Geophysics* 42: 2.23–2.24.

Udías, A. 2003. *Searching the Heavens and the Earth: The History of Jesuit Observatories*. Dordrecht: Kluwer.

Venturi, F. 1976. "Church and Reform in Enlightenment Italy: The Sixties of the Eighteenth Century." *Journal of Modern History* 48: 215–232.

Whitehead, M. 1986. "The Jesuit Contribution to Science and Technical Education in Late-nineteenth-century Liverpool." *Annals of Science* 43: 353–368.

Williams, D. 2007. "La creación del pueblo católico ecuatoriano, 1861–1875." In *Cultura política en los Andes (1750–1950)*, edited by C. Aljovín de Losada and N. Jacobsen, 319–345. Lima: IFEA/ Universidad de San Marcos.

Wolf, T. 1867. "Die Auswürflinge des Laacher-Sees." *Zeitschrift der Deutschen Geologischen Gesellschaft* 19: 451–492.

Wolf, T. 1879a. "Apuntes sobre el clima de las Islas Galápagos, según las observaciones hechas durante un viaje, en los meses de agosto a noviembre de 1875." *Boletín del Observatorio Astronómico de Quito* 1: 49–59.

Wolf, T. 1879b. "Ein Besuch der Galápagos-Inseln." *Sammlung von Vorträgen für das deutsche Volk* 1: 257–300.

Wolf, T. 1879c. "Bemerkungen über die Galapagos Inseln, ihr Klima und ihre Vegetation, nach Beobachtungen in den Monaten August bis November 1875." *Verhandlungen der berliner Gesellschaft für Anthropologie, Ethnologie und Urgeschichte* 6: 245–256.

Wolf, T. 1887. *Memorias sobre las islas Galápagos*. Quito: Imprenta del Gobierno.

Wolf, T. 1892. *Carta Geografica del Ecuador por Dr. Teodoro Wolf, publicada por orden del Supremo Gobierno de la Republica y Trabajada Bajo las Presidencias de los EE. Senores Dr. D. J. M. Placido Caamano y Dr. D. Antonio Flores*. Leipzig: Instituto geográfico de H. Wagner & F. Debes.

Wolf, T. 1895a. "Die Galapagos Inselen." *Verhandlungen der Gesellshaft für Erdkunde zu Berlin* 22: 246–265.

Wolf, T. 1895b. "The Galapagos Islands." *Geographical Journal* 6: 560–564.