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GEOLOGY AND RELIGION IN PORTUGAL

by

ANA CARNEIRO*, ANA SIMOES, MARIA PAULA DIOGO and TERESA SALOMÉ MOTA

Centro Interuniversitário de História das Ciências e da Tecnologia — Pólo Universidade de Lisboa, Faculdade de Ciências, Edif. C4, Piso 3, Gabinete 15, Campo Grande, 1749-016 Lisboa, Portugal, and Centro Interuniversitário de História das Ciências e da Tecnologia — Pólo Universidade Nova de Lisboa, Faculdade de Ciências e Tecnologia, Campus de Caparica, Edif. VII, Piso 2, 2829-516 Caparica, Portugal

This paper addresses the relationship between geology and religion in Portugal by focusing on three case studies of naturalists who produced original research and lived in different historical periods, from the eighteenth to the twentieth century. Whereas in non-peripheral European countries religious themes and even controversies between science and religion were dealt with by scientists and discussed in scientific communities, in Portugal the absence of a debate between science and religion within scientific and intellectual circles is particularly striking. From the historiographic point of view, in a country such as Portugal, where Roman Catholicism is part of the religious and cultural tradition, the influence of religion in all aspects of life has been either taken for granted by those less familiar with the national context or dismissed by local intellectuals, who do not see it as relevant to science. The situation is more complex than these dichotomies, rendering the study of this question particularly appealing from the historiographic point of view, geology being by its very nature a well-suited point from which to approach the theme. We argue that there is a long tradition of independence between science and religion, agnosticism and even atheism among local elites. Especially from the eighteenth century onwards, they are usually portrayed as enlightened minds who struggled against religious and political obscurantism. Religion—or, to be more precise, the Roman Catholic Church and its institutions—was usually identified with backwardness, whereas science was seen as the path to progress; consequently men of science usually dissociated their scientific production from religious belief.

Keywords: geology and religion in Portugal; anticlericalism; Inquisition; Salazar's dictatorship

*Author for correspondence (amoc@fct.unl.pt).

Introduction

The historical relationship between science and religion is complex. It has been expressed in different ways, depending on time, place, religious denomination, and social and individual attitudes towards natural phenomena, towards God, and towards the Church as an institution.[1]

In the specific case of a Roman Catholic country such as Portugal, the weight of religion has been perceived differently by national and foreign historians of science. Although recognizing it, the former usually tend to exclude the intellectual elites from religious influence because religion is often associated with obscurantism;[2] the latter simply take the power and influence of Roman Catholicism for granted, as pervading and having a lasting impact on all areas of life, including science. But the reality is far more complex and its analysis can enrich the historiography of this topic: locality seems, in this case, to be more relevant than peripherality.

When analysing the link between Genesis and geology, Nicolaas Rupke argues that in mainland Europe 'genesis and Geology never became as prominently controversial as it was in Britain and North America.'[3] He further argues that the reasons behind the lack of reverence for Scripture in French and German science are not the outcome of major differences in belief from that of British fellow naturalists but are the result of the existence of non-ecclesiastical professional niches, such as the Muséum d'Histoire Naturelle or the secular universities in the German States. Thus, the circumstances in which naturalists wrote on these topics were quite different from those of their British colleagues. In contrast with France and the German States, English cultural and religious life was dominated by Oxford and Cambridge, which were essentially Anglican seminaries, and consequently science had greater difficulty in becoming independent from religion. To this extent Rupke claims that 'both diluvianism and the geological design argument were examples of this phenomenon.'[4] Little is known, however, about geology and religion in European countries other than the three major European powers.

In this paper we argue that, to approach this relationship in a country such as Portugal, the emphasis placed by Rupke on the professional circumstances of geologists and naturalists seems even more decisive. What seems singular in the case of Portugal is that despite the almost complete absence of non-ecclesiastical professional niches, such as those mentioned by Rupke, the independence of science from religion was nevertheless kept for most of the eighteenth century and beyond.

Although being outside religious jurisdiction from 1772 onwards, there was only one university in Portugal (University of Coimbra) and no museums were available to absorb all those who wished to pursue a career in science. In this context, potential men of science were left with only three existing career structures: medicine, which was socially recognized and prestigious leaving little room for the practice of science; the clergy; and, in the nineteenth century, military engineering. Despite exceptions, such as the Oratorian priest Teodoro de Almeida (1722–1804), discussed below,[5] or other members of the fluid network of 'estrangeirados' (Europeanized intellectuals),[6] who tried to reconcile science with Roman Catholicism in the eighteenth century but did not delve explicitly or in any extended way into the relationship between geology and religion, we argue that, in general, in the eighteenth and nineteenth centuries, religious belief was not an issue for the Portuguese elites, including men of science, who normally did not dwell on the potential contradictions between science and religion.

However, Roman Catholicism, and notably the Jesuits, were perceived both by the absolute and the subsequent constitutional monarchy in the nineteenth century as a threat

to the progress of the country. During the eighteenth century, Portuguese intellectuals, including those belonging to the clergy, were often not inclined to discuss the impact of scientific theories on religion, mainly because religion was not always a matter of belief but was simply a path towards a successful career structure. In the nineteenth century a substantial number of engineers, the leading protagonists of Portuguese Liberalism, were devoted to scientific research, military engineering becoming in this context a significant career structure for the practice of science.

In the twentieth century, the dictatorship known as Estado Novo (1932–74) succeeded the Masonic, Jacobin and anticlerical Republic (1910–26). Despite the close relationships between the newly established regime and the Roman Catholic Church, António Salazar (1889–1970) maintained the separation of Church and State; in addition, the State held no official position regarding scientific matters. In this context, as an outcome of the Republican reform of higher education in 1911, which put an end to the monopoly of the University of Coimbra, a career devoted to scientific teaching and research had more chance to develop during the Estado Novo in one of the three universities or in the research institutes and centres that were created from the early twentieth century onwards. For the intellectuals and scientists aligned with the Republican tradition and opposing the dictatorship, religion and the Roman Catholic Church were perceived as obscurantist, science being an antidote to cultural and social backwardness. However, the Church and the Estado Novo also created their own elites, for whom science became central to their beliefs. In this instance, devotion to science and devotion to God were not seen as incompatible.

To fully ascertain the position of Portuguese men of science towards religion from the mid eighteenth to the twentieth century, available career structures and their social recognition undoubtedly have to be taken into consideration. But they in turn need to be articulated along with both biographic data and the local cultural, political and social framework. For this reason, the role of biography seems in this context particularly relevant in assessing how specific individuals managed their ideas, aspirations and anxieties with local trends and constraints.[7]

Going explicitly against the emphasis on local studies restricted to a narrow time frame, and offering a narrative covering several centuries by focusing on three case studies, corresponding to three historical periods of Portuguese history, this article offers a preliminary overview of the relations of geology and religion for Portuguese men of science, looking for major trends in this complex and evolving relationship. We begin by examining the late-eighteenth-century naturalist Abbot Correia da Serra (1751–1823),[8] a seemingly paradoxical agnostic priest devoted to science; this is followed by consideration of a duo leading the Portuguese Geological Survey in the nineteenth century, the military engineers Carlos Ribeiro (1813–82) and Nery Delgado (1835–1908);[9] finally we discuss Carlos Teixeira (1910–82),[10] a 'priest-like' scientist, professor of geology at the Faculty of Sciences of the University of Lisbon, and collaborator with the Geological Survey.

The eighteenth-century origins of anticlericalism

The absolute monarchy of José I, which lasted from 1750 to 1777, and the policies implemented by his Prime Minister, Marquis of Pombal, did not have the approval of significant sectors of the aristocracy or of the Roman Catholic clergy, who saw their former power and privileges greatly reduced. Pombal firmly defended the concept that the decisions of the king should prevail over ecclesiastic power, that is, *imperium* overruled

sacerdotium. Any threat to the sacred image of the king was considered as an act of sacrilege. In this context, the 1758 plot against King José I by a group of aristocrats gave Pombal the pretext he needed to reinforce his power. He ordered the execution of the leaders and the imprisonment of a considerable number of noblemen and women, and expelled Jesuits from the country in 1759. Although the Jesuits were not directly implicated in the conspiracy against the king, they had been fuelling the atmosphere of fear and hatred against Pombal and they represented the papal-driven ideology of the Counter-Reformation. They also controlled the teaching system and were accused of backwardness, because they were perceived as opponents to modernity. In Brazil, then a Portuguese colony, they were trying to build up a State that undermined Portuguese sovereignty. In addition to Pombal's contempt, which was shared by the laic intellectual elite, many elements of the secular clergy also hated the Jesuits. The measures that Pombal took against them and the diplomatic activity in various European monarchies led to their expulsion from France and Spain, as well as to the papal bulla that dismantled this religious order.[11]

Among the most relevant repercussions of Pombal's policies is the reform of the teaching system, notably the creation of the College of Nobles in 1761, and the reform of the University of Coimbra in 1772. Perhaps with the exception of the Oratorians, a religious order that was established in Portugal in the reign of João V (1707–50) to counterbalance the influence of the Jesuits and managed at times to avoid clashes with Pombal, all who opposed his enlightened despotism were persecuted.

Pombal's political downfall occurred when the King died in 1777. His daughter Mary I ascended to the throne and governed until 1792. Most political prisoners were then released but enlightened despotism continued, albeit in a lighter vein. The bourgeoisie and the new aristocracy ruled the country, the Jesuits were extinct and the power of the Inquisition was reduced. Much of Correia da Serra's life and career developed during this period, the complexities of which can be grasped by looking into his life.

Abbot Correia da Serra (1751–1823), a citizen of this world

Founder of the Academy of Sciences of Lisbon, in 1779, diplomat and first Ambassador of Portugal to the USA, the *estrangeirado* Correia da Serra was also a well-known naturalist to members of the intellectual and scientific elites of London, where he lived from 1795 to 1801, in Paris, where he stayed from 1801 to 1812, and of the USA, where he lived from 1812 to 1821.[12] He maintained friendly relations with Thomas Jefferson, Joseph Banks, James Edward Smith, Richard Anthony Salisbury, Robert Brown, Antoine Laurent de Jussieu, Georges Cuvier, Alexandre von Humboldt, the Marquis of Lafayette, Dupont de Nemours, and Augustin Pyramus de Candolle, to whom he became the intellectual mentor. Despite his early interest in geology, da Serra became internationally known for his original ideas as a botanist.[13] By fathering innovative concepts and methods, da Serra undoubtedly became a transitional figure from the eighteenth to the nineteenth century: beginning as a polymath with a utilitarian perspective on natural history typical of the Enlightenment, he turned into a botanist devoted to fundamental research on morphology and plant physiology (figure 1).

Correia da Serra was also a Roman Catholic priest who never actually led a parish, a situation not uncommon in eighteenth-century Portugal. In fact, this was also true of his

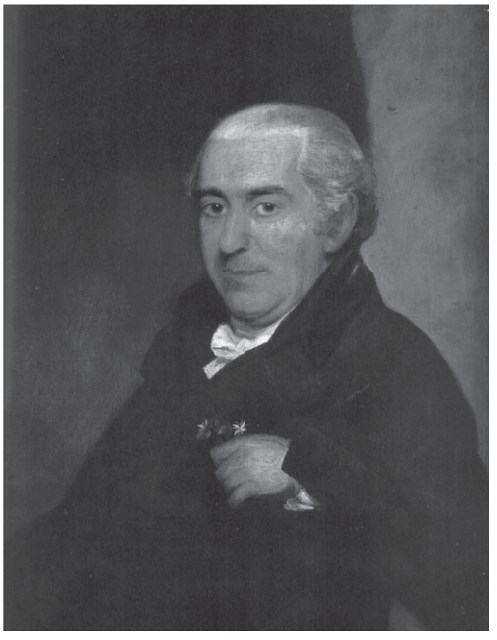

Figure 1. Portrait of Correia da Serra by Pellegrini. (Courtesy of Fundação Luso-Americana para o Desenvolvimento (FLAD).)

former tutor Luís António Verney (1713–92), when the young da Serra was living in Italy (1757–77).[14] Correia returned to Portugal, where he spent 20 years of his adult life—from 1777 to 1795—at the invitation of the Duke of Lafões, and participated in the foundation of the Academy of Sciences of Lisbon in 1779.[15] Indeed, da Serra became its driving soul, outlining and consistently implementing its research agenda.[16]

Just before returning to Portugal, in 1776, he was ordained presbyter in Rome, and graduated later in canon law in 1778.[17] He was even granted permission by Cardinal Borgia, secretary to the Inquisition, to read forbidden books, with the exception of those on judiciary astrology, superstitions or obscenity.[18] Despite former persecutions by the Inquisition of da Serra's relatives, and the fact that behind the family's early move to Italy there possibly lurked the spectre of persecution by the Inquisition, when he returned to Portugal he may have thought of applying for the position of notary to the Inquisition.[19] In the end, it transpired that by becoming a priest he was able to receive ecclesiastical pensions and benefits, which became a small but important financial resource throughout his troubled life.[20]

The choice of priesthood came as a surprise to some of Correia da Serra's close acquaintances. One of his friends blamed him for renouncing philosophy and deserting the sciences, and for having traded them for the false theories of the Roman canonists, an opinion that illustrates what Portuguese intellectuals belonging to his circle thought about religion and the Church:[21]

> Is it possible that this young man, in an age in which others know nothing, and who already caused the admiration of his acquaintances and should be the glory and

> ornament of his country, friend of first class savants and solace to his friends, will engage from today onwards in the study of false subjects? . . . The other sciences did not offer you a more brilliant, safe and sound path? . . . As ecclesiastic history and the knowledge of the Councils only lead to men's cunningness and imbecility, do you intend to persuade others of something that you know is false?

However, one can certainly understand Correia da Serra's reasoning in opting for such a degree at the time that he was planning to return to Portugal. To pursue a career in science in eighteenth-century Portugal, he had three options: graduating at the University of Coimbra and becoming one of its staff members, completing a degree in medicine or choosing the priesthood. But positions were scarce at the university and he had been persuaded to embark on the foundation of a scientific academy in Lisbon. Following his father's steps and choosing a career in medicine could be troublesome. He certainly did not forget that his father had been accused of practising alternative medicine, ending up as a merchant in Rome and Naples. By contrast, priesthood not only offered him a career structure but could also provide a cover for his inconvenient Jewish ancestry and a safe haven against religious or political threats.

In his formative years, Correia da Serra was educated by two clergymen: Abbot Antonio Genovesi (1713–69), a leading representative of the Italian Enlightenment and a political economist of Locke's school, and Father Giovanni Francesco Maratti (1723–77), whose lectures at the College of La Sapienza awakened da Serra's interest in the natural sciences, and specifically in botany.[22] They influenced him mostly in looking at priesthood as a means of pursuing his inclination towards the study of nature.[23] Despite his future degree, da Serra opted for intellectual pursuits other than theology or canon law, preferring Freemasonry to the Catholic Church,[24] and his endeavours as a naturalist shaped him as an active and devoted participant in the Republic of Letters.[25] His decision to pursue an ecclesiastical career was thus motivated by pragmatic reasons, because his life was never to be based on religious practice, whose norms he contradicted publicly.[26] Rather than a matter of faith or conviction, his choice of priesthood was a matter of convenience.

In his youth Correia da Serra wrote various memoirs on geology, of which a few have survived in the form of manuscripts and two were actually published. His thoughts on religion, or more precisely about the Roman Catholic Church as an institution, are expressed only in his manuscripts, which are basically travelogues of his field trips; in his publications there are no references to religious texts or any expression of religious belief whatsoever.

Between 4 and 24 April 1774, accompanied by his friend the Belgian physician Jean Demeste (1743–83), Correia da Serra travelled along the west coast of the Italian peninsula[27] with the intent of surveying the mineral resources and the mining plants of this region. He wrote a detailed diary in French, which can be considered a mixture of a fieldwork notebook and a narrative of travel literature.[28]

Among his observations are descriptions of animals, plants and minerals and of various mines of lead, bismuth, iron and 'diamonds' (in fact quartz crystals). He also analysed water to identify mineral content, and wrote detailed accounts on the mineral composition of various soils, using the nomenclature of Johan Gottschalk Wallerius (1709–95) to name minerals. Correia da Serra's anticlericalism is clear in secondary comments to his descriptions of human, rural and urban landscapes. When he described Cavo Morto he

mentioned that it possessed a stable population, a permanent number of 'souls', because of the many nuns and priests who lived there and who were not allowed to marry and procreate:[29]

> Among 2000 souls we find three convents of monks, one of nuns, a capitulary of 14 canons, priests and beneficiaries of parishes, as well as other priests called Patrimonianti. All useless people, but the nuns at least have some utility as they teach girls and run a public school.

Correia da Serra was furthermore very critical of the economic policies of the Papal State. The situation resulted, in his view, from the disastrous combination of a State monopoly and the tax system, particularly the tax on imports, whose single purpose was to enrich the Papacy. These kinds of considerations on the economy also revealed his intellectual affinities with his former tutor Genovesi as well as da Serra's general aversion to Papal policies and to the Church as an institution.

In the field-trip memoirs written after his journeys with Demeste in 1776–77 and 1785,[30] he introduced detailed and accurate fieldwork descriptions of geological features, showing his increasingly refined observation skills, essential to future theoretical hypotheses and interpretations.

When Correia da Serra returned to Portugal in 1777 he first disembarked at Cadiz, Spain, on the way to his home town. He began another travelogue and, as in his previous diary in 1774, he gathered together personal impressions and geological descriptions.[31] In addition to this manuscript he also wrote, in about 1785, two similar memoirs regarding his native province, the Alentejo,[32] which were essentially descriptive: 'I shall present the phenomena to you and their immediate consequences, that is, what we are sure about.'[33]

In his attempts at understanding the geology of Alentejo, Correia da Serra's considerations seem to point to a catastrophist vision of the history of the Earth, notably when he referred to the 'ancient successes and revolutions of nature'[34] and to the 'great movements of the globe'.[35] In general terms, it seems that his ideas originated from conceptions due to Georges-Louis Leclerc Buffon (1707–88),[36] but he especially developed implications that Buffon had not explored—volcanism and catastrophism.[37] Correia da Serra also drew from the theories of Johan Jacob Ferber, who had performed geological studies in Italy during his 1774 trips, in which he was accompanied by da Serra, and in 1776.[38]

In 1785 Correia da Serra completed his research on the Alentejo with a memoir in which he adopted a totally historical perspective, basing his conclusions on documents kept in various archives of the region.[39] This manuscript shows his interest in history understood as a complement to his work as a naturalist, and for this reason it shares with natural history a methodological concern for objectivity. In this memoir he once again criticized the obscure relationships between spiritual and temporal powers, and in one paragraph he described the Papal material pretensions regarding Portugal as 'nauseating'.[40]

Correia da Serra's first scientific article was published in London, in 1799, during his exile in Britain, where he came under the protection of Sir Joseph Banks (1743–1820). In this paper he described the results of a field trip undertaken with Banks to Sutton, on the coast of Lincolnshire. The trip was meant to study the 'islets of moor', composed essentially of decayed trees of the former Doggerland, which extended along the coast, and which were only observable during the lowest ebbs of the year. The observations of da Serra and Banks began in the equinox of 19 September 1796 and lasted two days. As a recent member of the Royal Society, da Serra delivered a paper entitled 'On a

Submarine Forest on the east Coast of England', which was published three years later in *Philosophical Transactions*.[41]

In this article he did not resort to supernatural explanations, he separated 'facts' from 'interpretations',[42] and he concluded that the origin of the submerged forests was the result of 'a force of subsidence', which was a natural consequence of gravity and more effective in soft soils to such an extent that it could have its actions 'quickened and rendered sudden by extraneous causes, for instance, by earthquakes'.[43] As he argued, this explanation was simple and its probability was corroborated by similar cases, and not liable to the objections against the 'hypothesis of the alternate depression and elevation of the level of the ocean', an opinion that to be acceptable required more evidence than that produced so far.[44]

In this and subsequent memoirs, Correia da Serra's geological work was based on fieldwork and it evolved from the mere description of rocks and minerals to a more sophisticated stage in which he sought to find causes for the phenomena observed. He was opposed to explanations that were not strictly based on observation; references to biblical interpretations were simply absent.

As already noted, another dimension of Correia da Serra's life was his involvement with the young Academy of Sciences of Lisbon, an institution with which Teodoro de Almeida was also engaged. Almeida published the multi-volume *Philosophical Recreation*, which touched upon a variety of topics of natural philosophy, but said little about geology, constituting a long and sophisticated exercise aimed at reconciling the Enlightenment with religion, and specifically with Roman Catholicism. At the Academy of Sciences of Lisbon, however, there is no evidence that Correia and Almeida ever discussed these issues, or for that matter that they were discussed at the academy's meetings. But the progressive ideological estrangement between the two, evident from da Serra's criticisms of Almeida's growing scientific outmodedness, might have been the result of their divergent scientific agendas:[45] the then utilitarian project of da Serra, for which religion did not play any role, and Almeida's reconciliation programme, for which utility was not a commanding issue outside the context of the design argument. Despite the role of controversies in many instances of Portuguese intellectual and scientific life, religious matters or the articulation of science and religion were not structuring arguments in scientific discourse based on original research, nor were they preferred topics for intellectual debates.

As we have shown, religion was never a matter of personal belief to Correia da Serra, but merely a way to get an education in the natural sciences, a career structure and, he hoped, a safe haven. Taking all these points into consideration, what the American historian Kenneth Maxwell called an 'enigma'—'how a Catholic priest in the late eighteenth-century should become one of the closest friend(s) of the sage of Monticello [Thomas Jefferson], a deist and Unitarian who had little good to say about organized religion'[46]—becomes easily understandable.

From the historiographic point of view, it is normally assumed that the Reformation was more actively involved in the production of scientific knowledge than the Counter-Reformation. On this assumption, a scientist from a Protestant country would have greater freedom than one living in a country dominated by Roman Catholicism. If in social terms the presence of Catholic theology as a framework for thought is more visible, at an individual level matters of faith are more flexible in Roman Catholic countries than in those marked by the Reformation. In this sense it comes as no surprise that a Catholic

priest could also be a Freemason or could adopt sexual practices contrary to those professed by his religious denomination. The strong ritualization of Roman Catholicism, including the practice of confession for all sinners, reinforces the public expression of religious belief but weakens its private dimension, facilitating deviations from the canon. Protestantism, in contrast, by being less ritualized entails a more private and intimate understanding of the cult. If instead of the stereotyped perspective of the Counter-Reformation one takes into consideration this duality, the answer to Maxwell's enigma becomes simple.

Decadence, liberal anticlericalism, and regeneration

After the Liberal revolution of 1820, which effected the transition from absolutism to a constitutional monarchy, the motives and expectations of Portuguese nineteenth-century political thinking diagnosed Portuguese society as being decadent and in need of regeneration. The measures to achieve this end varied in accordance with political and ideological perspectives, which fell roughly into two categories: the first advocated the return to traditionalistic solutions; the second, which already had adepts among the defenders of the constitution of 1826, to whom 'revolution' was equivalent to 'regeneration', was shared by various political movements. The so-called Regeneration based its arguments on the dichotomy between decadence and regeneration, and ultimately aimed at legitimizing a bourgeois order.[47] In this context it was understood that religion, both as an institution and as a cultural and social phenomenon, although reformed, had to keep its decisive role in society's life, which led to contradictory consequences: on the one hand, various governments compromised with the Church; on the other, projects of total laicization of Portuguese society grew together with anticlericalism. As the Church was generally conservative and opposed Liberalism, Liberals sought to dismantle or limit its power.[48] These contradictions mirrored a country divided into an urban, educated and politically active elite, and a rural and uneducated world dominated by traditional, conservative clergymen.

Liberal anticlericalism criticized the role of the Church after Trento and the creation of the Inquisition as being responsible for the country's decline; by the middle of the century this criticism extended to the secular clergy, which was accused of counteracting the propagation of Liberal ideas and of being an obstacle to progress. Moreover, the strong nationalistic component of Liberalism presupposed that the Church should be part of the Portuguese political system, which would allow it to be ruled by national interests. This vision opposed the Vatican's concept of an international Roman law that transcended national borders. The criticisms levelled at Roman Catholicism grew deeper and harsher. In 1834 religious orders were banned from Portugal, and the atmosphere of tension between the Portuguese State and the Vatican continued until 1848.[49] The signature of the 1848 treaty was, however, just a short period of calm before a new storm. The conservative factions of the Church regrouped in the 1850s, and until the 1880s there were continual disagreements, which eventually led to more radical positions, namely those of socialists and Republicans, who defended a clear separation between the State and the Church.

Either influenced by Hegel or inspired by Positivism, the intellectuals of the 1860s and 1870s envisaged religion as a stage of spiritual objectification, or as peculiar to the 'theological stage', the first in the history of mankind, and consequently an anachronistic manifestation in subsequent stages of human development. The symbolic interpretation of

Figure 2. Portraits of (*a*) Carlos Ribeiro and (*b*) Nery Delgado. (Courtesy of Arquivo Histórico do Laboratório Nacional de Energia e Geologia (LNEG).) (Online version in colour.)

Christ by the disciple of Hegel, David Friedrich Strauss (1808–74) in his *Das Leben Jesu kritisch bearbeitet*, was published in Tübingen in 1835–36. Strauss used his knowledge of biology and geology to criticize the literalist interpretation of Scripture,[50] which together with the philological criticism of the Bible by his French follower Ernest Renan (1823–92) supplied 'scientific' arguments, reinforcing secularism among most Portuguese intellectuals.[51] The geologists Carlos Ribeiro and Nery Delgado were close to those who fell in this category, notably those who participated in or gravitated towards the intellectual movement known as the '1870 generation' ('Geração de 70'), engaged in renewing Portuguese society, culturally, morally and politically, and in fighting against the decline of the Iberian peoples.[52]

Officiates of progress: Carlos Ribeiro (1813–82) and Nery Delgado (1835–1908)

Despite their distinct social backgrounds—Ribeiro came from a modest family and Delgado from a family with military traditions—both were military engineers and were a product of the Liberal Revolution, which caught Correia on his arrival in Portugal in his later life.

Ribeiro (figure 2*a*) and Delgado (figure 2*b*) epitomize the continuation of the lay character of the natural sciences in Portugal, in the second half of the nineteenth century. However, in terms of a career structure in science, unlike those open to Correia, a new option was now available to them: engineering as a career in civil service.

In 1857 the Portuguese Geological Survey (Comissão Geológica do Reino) was established, as a section of the Directorate of Geodesic, Chorographic, Hydrographical Works of the Kingdom (Direcção Geral dos Trabalhos Geodesicos, Chorographicos, Hydrographicos do

Reino) within the Ministry of Public Works, Trade and Industry, with the mission of elaborating a geological map of Portugal. A former protégé of the prestigious cartographer Filipe Folque (1800–74), then heading the Geodesic Directorate, and a former colleague in the Army School of Fontes Pereira de Melo (1819–87), the leading statesman of Portuguese Liberalism, Ribeiro was appointed director of the Geological Survey, a position he held until his death in 1882. His younger colleague, Delgado, also a military engineer, was then given the position of adjunct.[53] Ribeiro had had connections with the Delgado family since the days when he was stationed in Elvas, whose military fortification had been governed by both Delgado's father and grandfather. In the context of the Geological Survey, he initiated his young friend in the practice of field geology.

In terms of their careers Ribeiro and Delgado are fine examples of the kind of institutional and professional trajectories typical of mid-nineteenth-century Portugal, and one of the three possible professional paths—law, medicine and engineering—behind the education of the scientific and ruling elites. They also typify the accession to a higher social rank by people outside the clergy, the aristocracy and the bourgeoisie. With few exceptions, aristocrats had little inclination for science, and the bourgeoisie were usually more oriented to law and medicine, two professions socially recognized as prestigious; however, from 1837 onwards, military engineering also became a promising career option, the Ministry of Public Works becoming the major employer for Portuguese engineers.

Both Ribeiro and Delgado thus benefited from a certain degree of institutionalization, not so much in the realm of science but in that of engineering, which was seen by the Liberals as a quick fix to the structural problems of Portuguese society. Professionally, they were never institutionally acknowledged as geologists but as engineers.

Ribeiro was the first Portuguese geologist to establish the overall stratigraphic succession of the Portuguese territory. He had begun performing geological research in 1840 on a private basis and was probably the only person in the country devoted to research in this field. He and Delgado co-authored the first geological map of Portugal (1:500 000), which was officially published in 1876. But in addition to cartography and geology, in which religious considerations are simply absent from their works, they became interested in palaeoanthropology and archaeology. This interest in the origins of Man was derived from evolutionist theories, notably after the 1859 publication of Darwin's *Origin of Species* and, in particular, from the reading of the discoveries of Boucher de Perthes (1788–1868), who wrote *De l'Homme antédiluvien et de ses œuvres*, published in 1860.[54] De Perthes had concluded that Man was contemporaneous with certain extinct animals in a period before the Flood, and that climates had changed, because there were elephants and rhinoceros in the Somme valley of northern France. One was thus able to distinguish a tropical period from a glacial and a mild period.[55]

The engagement of Ribeiro, followed by Delgado, in archaeological and palaeoanthropological research dated back to 1863. While studying the Tertiary of the Tagus valley, Ribeiro discovered the kjökkenmöddinger of Muge—shell marls and vestiges of human food, dating from the Mesolithic.[56] During his investigations he identified human remains, fossilized bones of animals, and objects cut in stone and bone, which allowed him to derive information on the lifestyles of the populations that inhabited the banks of River Tagus. Ribeiro claimed the existence of Man in the Tertiary, and because of the interest awakened in the international community he and Delgado organized the IX International Congress of Archaeology and Paleoanthropology in 1880.[57] They were especially interested in promoting the convergence of geology, palaeontology

and anthropology, within an overall evolutionary approach, by providing the study of the evolution of Man with a geological foundation.[58]

It is worth mentioning that by the same period the botanist Júlio Henriques (1838–1928), with whom Ribeiro was friendly, when competing for a teaching position in the Faculty of Philosophy of the University of Coimbra in 1866,[59] submitted a dissertation entitled *Antiquity of Man*. On the basis of archaeological and palaeoanthropological vestiges, he described the evolution of the human species, in the context of different environments throughout the history of the Earth.[60] His dissertation was well received, and as a consequence in 1869 he was appointed substitute lecturer for the courses in the University of Coimbra on botany and agriculture, zoology, and chemistry and mineralogy.

Like most Portuguese Liberal intellectuals and the ruling elite—often with Republican leanings, anticlerical attitudes and in some cases an inclination towards utopian socialism—Ribeiro and Delgado embraced evolution, which was never a polemical issue in Portugal.[61] However, from a letter addressed to Ribeiro by his friend, the journalist and Lisbon chronicler João Pinto de Carvalho (1858–1936),[62] probably dating from 1872, one gains a hint of the kind of spirit prevailing among their circle of friends. Pinto de Carvalho wrote a letter permeated with irony, thanking Ribeiro for the proceedings of the meeting of the International Archaeological and Palaeoanthropological Congress held in Brussels[63] in 1872, as follows:[64]

> I thank you the kindness of sending me the Proceedings, which could not have arrived at a most appropriate moment because for two years I do not read but Büchner, Darwin and Strauss. The origin of species, the ascendance of men and other things that naturalists have demonstrated, have confused my brain [tem-me embrulhado o miolo]. The mollusc was the builder of the Universe! Man inhabited the Tertiary and originated from the mollusc, naturally! How could I ever have imagined it! How can consequences so complex derive from such small things? You, gentlemen savants, spoiled the Adam legend so dear to me, which had gone around the world, despite being a product of the imagination of rough and ignorant people. If I could not be saved, you will be held partly responsible . . ..

The references to Darwin and Strauss are telling, and that to Ludwig Büchner (1824–99) echoed the materialistic controversy of the 1850s. Atheists and materialists such as Büchner, together with Karl Vogt (1817–95) and Jakob Molleschott (1822–93), were all men of the laboratory, who—as Chadwick emphasized—dissected the human body and could say 'they find no soul therein'.[65] But Carvalho's letter also shows eloquently the casualness with which people moving in the circles of Ribeiro and Delgado mocked religious prejudices regarding evolution and the origins of man. Those who might be prejudiced about these questions were in their view the odd exception, and they deserved to be laughed at, even if privately, and ranked among the rough and ignorant.

The satirical tone resurfaced again, but this time publicly, in 1880, after the above-mentioned meeting held in Lisbon of the International Congress of Archaeology and Paleoanthropology. The meeting had the patronage of King Luís I, was presided over by his father Don Fernando, and was attended by eminent international experts[66] and by the Portuguese ruling and intellectual elite. As said previously, Ribeiro claimed to have found human vestiges in the Tertiary, and his evidence and arguments were discussed at length. Rudolf Virchow (1821–1902) opposed Ribeiro's claims, which nevertheless found acceptance by Gabriel de Mortillet (1821–98), who even taught the topic in his courses

at the École d'Anthropologie in Paris.[67] This question was immediately satirized by the Portuguese journalist and caricaturist Rafael Bordalo Pinheiro (1846–1905) in his newspaper *O António Maria*,[68] but only on political grounds—Ribeiro was caricatured, and the 'Man of the Tertiary' was represented by the Duque of Ávila (1807–81), former Chancellor of the Exchequer and then Prime Minister—which again reinforces the point that religious implications around the origins of Man were irrelevant to these men.

Both Ribeiro and Delgado were baptized, and in accordance with the local tradition when they died they had a Roman Catholic funeral, whose significance was (and still is) often more social than religious. So far there are no indications of whether or not they were regular churchgoers or Christian believers, but what can be said for sure is that they made a clear separation between science and religion. In matters of God they were totally silent. References to religion in their scientific writings are absent and they never expressed religious ideas publicly; if they had them, they kept them private.[69]

From the Republican revival of the 'Jesuit conspiracy' to the revitalization of the Roman Catholic Church

In 1910 Portugal became a Republican State. The official programme of the Portuguese Republican Party, which had been formulated in 1891, advocated the secularization of public life. The idea of a Jesuit conspiracy was revived by Republican propaganda, echoing anticlerical movements, which occurred in France in 1905, when the separation between the Church and the State took place. Fuelled by the Republican press, Jesuitism became synonymous with anti-Republicanism. However, by the end of the nineteenth century, new religious orders had managed to circumvent the prohibition of 1834 and established themselves surreptitiously in the country, becoming an easy target for the Republicans; anticlericalism became then the kernel of the intrinsically Masonic Republican movement of 1910.[70]

Republican radicalism reopened the so-called 'religious issue', which led ultimately to the reinforcement of the political activity of Catholic groups that shared the ideology of Christian democracy. In the 1920s the Catholic Church was revitalized; as in France, the wave of conversions to Roman Catholicism among Republican intellectuals grew, strategically prepared and carefully monitored by the Church, and this became a symbol of the resistance to factionalism and oppression from freethinkers. The number of Catholic organizations, meetings and conferences also increased, and by 1930 Portuguese bishops expressed their intention of creating a Roman Catholic cultural elite.[71] Catholic intellectuals organized themselves: as early as 1912, just in the aftermath of the strong anticlerical Republican offensive, a group of young students from the University of Coimbra became the leaders of the catholic renaissance: António Salazar (1889–1970), later the head of the Portuguese authoritarian regime Estado Novo, and Gonçalves Cerejeira (1888–1977), later the Cardinal of Lisbon and an influential figure of the regime.[72]

One of the measures launched by the Republicans with clear repercussions in scientific life had been the 1911 reform of higher education, which had created the universities of Lisbon and Oporto, and a technical university in Lisbon. Subsequently, a government agency to fund research was established, and the first specialized scientific societies emerged, which testify to the poor standards of institutionalization of scientific practice in Portugal and, unlike in engineering, the difficulty in achieving formal professional recognition in the sciences.

However, the political instability caused by the consecutive changes of government during the First Republic, and the desperate state of finances, created the conditions for the establishment of a dictatorship. In 1932 António Salazar established a totalitarian regime, the Estado Novo, which ruled the country until 1974. Restrictions on the freedom of speech and association were imposed, as were censorship, a single political party—which invariably won elections—and a political police, controlling every aspect of Portuguese life, at both the collective and personal levels.

During this period, the relationship between the Roman Catholic Church and the State was close, but the Catholic dimension of Estado Novo should not be overstated. Unlike in Franco's Spain, Salazar's regime presented itself not as an 'apostolic' system, engaged in a crusade against anti-Catholics, but as a Christian-democratic regime. By defending the priority of the moral standpoint over political issues, Salazar did not accept any sort of domineering influence of the Church upon the State, and opposed a direct intervention of the Church in politics.[73] Salazar was committed to defending the 'Christian Western civilization' against communism rather than an alliance in which the State would be dominated by the Catholic Church.[74]

Carlos Teixeira (1910–82), the 'apostle' geologist

Carlos Teixeira, one the most influential Portuguese geologists of the twentieth century, was to some extent a product of the reforms implemented by the First Republic, but his career developed in the context of the Estado Novo (figure 3).

He is generally associated with the image of the scientist/priest who completely devoted his life to work. This image was built and perpetuated by Teixeira's disciples and friends, on the basis of not only the high level of his scientific performance but also the characteristics of his personality. He renounced the mundane aspects of existence, the image of his life being one of human and material sacrifice inaccessible to common men, in complete dedication to geology.[75] However, a more careful analysis of Teixeira's life shows that, contrary to this kind of image, his scientific and professional success was due not only to his talent but also to the support he received from people associated with the Estado Novo, notably his mentors Mendes Correia (1888–1960) and Carrington da Costa (1891–1982).[76]

Born in Aboim, a small village in northern Portugal, Teixeira studied in the Faculty of Sciences of the University of Oporto, where he completed a degree in historical-natural sciences,[77] in 1933. Despite belonging to Mendes Correia's research school of anthropology,[78] Teixeira ended up embracing geology, influenced by Domingos Rosas da Silva (1896–1967) and Carrington da Costa, who were both professors of geology at the University of Oporto.[79]

In addition to having oriented Teixeira's early scientific career,[80] Mendes Correia influenced him in the way in which he conceived scientific practice and perceived the situation of science in Portugal. As a member of the National Assembly in 1945 and 1957, Correia intervened as an advocate of scientific research,[81] becoming a spokesman for Portuguese geology and the geological community in the political sphere,[82] in close association with Teixeira.

In 1938 Teixeira was granted a scholarship from the Institute for High Culture and went to the University of Lille, in France, where he worked with Pierre Pruvost (1890–1967), a palaeontologist and geologist who specialized in the Palaeozoic coal basins, and with Paul Bertrand (1879–1944) and Paul Corsin (1904–83), two specialists in Palaeozoic floras.[83]

Figure 3. Photograph of Carlos Teixeira (on the right, wearing a black beret) with some other geologists during fieldwork. (Courtesy of Arquivo Histórico do Laboratório Nacional de Energia e Geologia (LNEG).)

After the completion of his doctorate in palaeobotany[84] in 1944, he engaged primarily in the study of palaeontology, stratigraphy and tectonics of the continental Carboniferous in Portugal. He moved to the University of Lisbon in 1946, where he stayed throughout the rest of his entire academic career, teaching geology in the Faculty of Sciences. Teixeira was a gifted fieldwork geologist who authored and co-authored a variety of geological maps.[85] His cartographic contributions were produced in the context of his formal collaboration with the Portuguese Geological Survey from 1944 onwards.

Teixeira also had the support of his early mentor in geology, Carrington da Costa, in particular in his appointments to the Councils for Nuclear Power (Junta de Energia Nuclear) and Colonial Research (Junta de Investigação Científica do Ultramar),[86] where he was consultant and director of the palaeontological and petrological laboratories, initiating his studies on the geology of Portuguese possessions in Africa and Asia.[87]

A leading figure in the renewal of the Portuguese university during the 1930s and 1940s, Carrington da Costa moved to the University of Lisbon in the 1950s and was co-founder with Teixeira of the Portuguese Geological Society (Sociedade Geológica de Portugal) in 1940. Teixeira engaged in the public defence of geology and geologists by writing in scientific

journals, scientific magazines and even in the daily press, within a general advocacy of science but especially to counteract the lack of recognition of these professionals whose functions had been traditionally fulfilled since the nineteenth century by military, mining and civil engineers.

In 1956 the Centre for Geological Studies (Centro de Estudos de Geologia) was created in the University of Lisbon, Teixeira becoming its director. He established a research school that had a fundamental role in changing the course of Portuguese geology. While leading his research school, Teixeira attained high levels of scientific productivity, publishing works on the geology of mainland Portugal and the Portuguese Atlantic islands, African and Asian colonies.[88] Essentially focused on palaeontology, stratigraphy and tectonics, Teixeira's work represents a classic and generalist approach to geology. He concentrated on Earth history rather than on the dynamics of geological processes, which is not surprising given that he was a geologist from the era before plate tectonics.

In his vast geological output Teixeira never addressed religious questions. Catholicism was never an obstacle to his scientific practice, because he easily kept his religious beliefs separate from his science. One of the few writings in which he approached religious questions was in his book *Palaeontology and the Origin of Man* (*A Paleontologia e a Origem do Homem*),[89] in which he adopted a position similar to those nineteenth-century naturalists who accepted Darwin's theory on the origin and evolution of species but considered the evolution of Man from other primates as a result of God's intervention, a view apparently acceptable to the Portuguese Roman Catholic authorities although there is no evidence of an official position of the Church regarding this matter.[90]

Teixeira is described by his disciple Francisco Gonçalves (1926–97) as having 'led a life of true priesthood', because he decided to remain a bachelor all his life.[91] But he was also seen by one of his most distinguished students and opponent to the dictatorial regime, António Ribeiro (born 1939), as someone who had imposed on himself a monastic devotion to science, which completely overshadowed the possibility of a cultural and civic intervention.[92]

Teixeira's Catholic upbringing must have been decisive in the way in which he envisaged geological practice. He never knew who his father was; he was raised by an uncle who was a priest.[93] Even if not much is known about Teixeira's religious practices,[94] ideals derived from Roman Catholicism such as hard work, dedication, sacrifice, and indifference to material goods must have shaped his scientific and professional persona. Similar values were also preached by Estado Novo, and found acceptance in Portuguese society chronically plagued by economic hardship and poverty.[95]

With the aim of turning Teixeira into the father of modern Portuguese geology, his aura was gradually built up by his friends and disciples, and he was given a place in the lineage of the Portuguese geologists of the nineteenth century, Ribeiro, Delgado and Paul Choffat (1849–1919);[96] but he undoubtedly set the tone. They portrayed Teixeira's scientific and professional career as exclusively dependent on his exceptional personal attributes and scientific achievements. If it is true that he 'never sought for profitable positions', he nonetheless sought scientific prestige,[97] and to this end his ties to some figures with political and institutional relevance during the Estado Novo were nonetheless important.

Without being directly politically compromised with the regime,[98] Teixeira knew how to take advantage from its nationalistic features in order to pursue his scientific interests, an attitude which was not uncommon among men of science living under dictatorial

regimes.[99] In this respect, Carlos Teixeira was no exception for he was no saint but only a talented scientist.

Concluding remarks

If one looks for a broad overview of the relationships of geology and religion in Portugal, between the mid eighteenth century and the mid twentieth century, the first major conclusion is that a separation between geology and religion prevailed among Portuguese intellectuals, even extending to clergymen.

Given the poor institutionalization of the sciences in Portugal, where until 1911, the single university was that of Coimbra, and the Royal Academy of Sciences of Lisbon the only significant scientific society, the three case studies presented in this paper show that in addition to medicine, a clerical career in the eighteenth century, and a military engineering career in the nineteenth century provided, above all, not only an education but also an institutional framework, on which to base the practice of science.

In the anti-Jesuit eighteenth century, Correia da Serra was agnostic despite his religious career as a secular priest, which was chosen on merely practical grounds: it provided him with an education, an economic structure for the practice of science and a shield against potential persecution from the Inquisition on the grounds of his Jewish ancestry. Correia never participated in discussions on religion in the Academy of Sciences of Lisbon because seemingly its members did not entertain this kind of discussion. He expressed no views on possible contradictions between geological interpretations and Genesis in his printed geological work, but in his manuscripts reporting fieldwork he freely expressed his criticisms of the Roman Catholic Church as an institution. During his exile in Britain he probably became acquainted with discussions on the religious implications of geological knowledge, but he never referred to them; in turn, during the period when he was working in the Parisian Muséum, the separation he made early in his life between these two domains must have been reinforced.

In the nineteenth century, a period during which the process of secularization grew, the accusations levelled at the Church of being an obstacle to progress extended to the secular clergy. Thus, those who wished to pursue a career in science but had not previously had the means to do so now had a new career structure, that of military engineering within the civil service. Hence for men such as Ribeiro and Delgado, both military engineers aligned with Liberalism, religion was never an issue. They never expressed their religious beliefs publicly, nor in their scientific writings. If deep down they had any, they kept them private, even in matters potentially sensitive such as the origin of Man.

In the twentieth century, with the creation of the universities of Lisbon and Oporto by the anticlerical Republicans, and the creation of the first designed State institutions to fund research, Teixeira was able to become a geologist; that is, a specialized scientist. Brought up in the provinces, educated by a clergyman and living his productive life during Salazar's dictatorship, Roman Catholicism shaped the moral values that Teixeira associated with the practice of science: fieldwork had the contours of a spiritual and ascetic exercise, and the communication of geological knowledge to wider audiences was a duty of the scientist similar to spreading the gospel. However, his attitude towards the moral values that should mould scientific practice did not differ much from those of the

intellectuals of the anticlerical and agnostic First Republic imbued with positivistic ideology. These values were also shared by the opponents of the subsequent dictatorship, who despite being identified with the Left often partook of a similar spirit of mission, or more precisely of scientific proselytism.

The case studies presented show that to approach the complex relationship between science and religion in Portugal it is indispensable to articulate biographic data with the career structures available to the practice of science, as well as with social, cultural and political trends and constraints regarding the Roman Catholic Church as an institution rather than a system of religious belief. The three examples should now be complemented in the future by more detailed case studies.

Undoubtedly, a tradition within Portuguese intellectual and political elites of independence between scientific and religious convictions developed from the eighteenth century onwards. The absence of public debates over the possible contradictions between science and Scripture was striking, especially in scientific fields such as geology and the origins of Man, in which these questions traditionally had a particular strong relevance.

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Notes

1 J. H. Brooke, *Science and religion. Some historical perspectives* (Cambridge University Press, 1991); M. Rudwick, *Bursting the limits of time* (University of Chicago Press, 2005).

2 Only recently have the contributions of the Portuguese clergy to science been an object of research. See, for example, L. M. Carolino, *Ciência, astrologia e sociedade. A teoria da influência celeste em Portugal* (*1593–1755*) (Fundação Calouste Gulbenkian, Fundação para a Ciência e a Tecnologia, Lisbon, 2003), and a corresponding book review appearing in *J. Hist. Sci. Technol.* **1** (2007) (http://www.johost.eu/vol1_summer_2007/host_vol1_henrique_leitao.pdf, accessed 9 June 2008); H. Leitão, 'A história da ciência e a revista *Brotéria*', in *Fé, ciência, cultura. Brotéria 100 anos* (ed. Hermínio Rico and José Eduardo Franco), pp. 327–350 (Gradiva, Lisbon, 2003); H. Leitão, *A ciência na aula da esfera do Colégio de Santo Antão, 1590–1759* (Comissariado Geral das Comemorações do V Centenário do Nascimento de S. Francisco Xavier, Lisboa, 2008); J. A. Silva, *A apropriação da filosofia natural em Teodoro de Almeida* (*1722–1804*) (CIUHCT, Braga, 2009); J. A. Silva, 'The 18th century Portuguese Oratorian priest and popularizer of science Teodoro de Almeida (1722–1804): agendas, publics, and bilingualism', *Hist Sci.* **50**, 93–122 (2011); F. C. Domingues, *Teodoro de Almeida. Ilustração e Catolicismo* (Colibri, Lisbon, 1994).

3 N. A. Rupke, 'Geology and palaeontology', in *Science and religion. A historical introduction* (ed. Gary B. Ferngren), pp. 191–192 (Johns Hopkins University Press, Baltimore, MD, 2002).

4 *Ibid*.

5 Silva, *op. cit.* (note 2); Domingues, *op. cit.* (note 2).

6 A. Carneiro, A. Simões and M. P. Diogo, 'Enlightenment science in Portugal: the *estrangeirados* and their communication networks', *Soc. Stud. Sci.* **30**, 591–619 (2000); A. Simões, A. Carneiro

and M. P. Diogo, 'Constructing knowledge: eighteenth-century Portugal and the new sciences', *Archimedes* **2**, 1–40 (1999).

7 On the importance of a biographic approach see J. H. Brooke and G. Cantor, *Reconstructing nature. The engagement of science with religion* (Oxford University Press, 1998), pp. 31–32.

8 A. Simões, M. P. Diogo and A. Carneiro, *Cidadão do mundo. Uma biografia científica do Abade Correia da Serra* (Porto Editora, Porto, 2006) with an English translation as A. Simões, M. P. Diogo and A. Carneiro, *Citizen of the world. A scientific biography of the Abbé Correia da Serra* (Institute of Governmental Studies Press/University of California, Berkeley, CA, 2012); J. C. da Serra, *Itinerários histórico-naturais* (ed. A. Simões, A. Carneiro and M. P. Diogo) (Porto Editora, Porto, 2003).

9 A. Carneiro, 'Outside government science, "Not a single tiny bone to cheer us up!" The Geological Survey of Portugal (1857–1908), the involvement of common men, and the reaction of civil society to geological research', *Ann. Sci.* **62**, 141–204 (2005); A. Carneiro and T. S. Mota, 'The Geological Survey of Portugal (1857–1948), an overview', *Earth Sci. Hist.* **28**, 85–96 (2007); A. Carneiro, 'Sharing common ground: Nery Delgado (1835–1908) in Spain in 1878', in *Four centuries of geological travel: the search for knowledge on foot, bicycle, sledge and camel* (ed. P. N. W. Jackson), pp. 119–134 (London Geological Society, London, 2007).

10 T. S. Mota, *Os serviços geológicos entre 1918 e 1974; da quase morte a uma nova vida* (PhD thesis, New University of Lisbon, 2007).

11 A. H. O. Marques, *História de Portugal*, vol. 1, pp. 570–574 (Palas Editores, Lisbon, 1977).

12 On the role of Correia da Serra as a *estrangeirado* (Europeanized intellectual) member of an informal network of intellectuals motivated by the wish to include Portugal in the European cultural movements, see Carneiro *et al.*, *op. cit.* (note 6).

13 Correia's contribution covered the analogical demonstration that algae do reproduce sexually at a time when this question was still controversial, the adoption of a natural method of plant classification based on analogies extending to internal structures, the extension of comparative anatomy from zoology to botany at a time when this was still an uncommon practice among botanists, and finally the concept of symmetry as a guide to classification. M. P. Diogo, A. Carneiro, A. Simões, 'The Portuguese naturalist Correia da Serra (1750–1823) and his impact on early nineteenth-century botany', *J. Hist. Biol.* **34**, 353–393 (2001); Simões *et al.*, *op. cit.* (note 8).

14 When Luís António Verney (1713–92) was 17 years old he left Portugal for Rome, where he completed his education. Already an influential presbyter, he had a decisive role in the educational reform of King José I; however, displeased by court intrigue, Verney returned to Rome, where he died. Friendly with Correia da Serra's father, Verney had an important role in the son's education. See Simões *et al.*, *op. cit.* (note 8).

15 The Duque of Lafões, a former colleague of Correia's father at the University of Coimbra, was a Europeanized intellectual and diplomat who travelled extensively in Europe and met young Correia da Serra in Rome.

16 Simões *et al.*, *op. cit.* (note 8).

17 His dissertation was entitled 'La Filosofia della successione o sia Discorso Filosofico sulla natura e gli effeti della successione dei beni', National Archives, Torre do Tombo, Lisbon (hereafter ANTT), Manuscritos de Correia da Serra, A22.

18 ANTT, Manuscritos de Correia da Serra, B27.

19 ANTT, Manuscritos de Correia da Serra, C10. Correia da Serra probably never submitted this application to the Inquisition, because nothing was found in his file or in the Inquisition Archives. ANTT, Manuscritos de Correia da Serra, B23, B23A and B23B. It is unlikely that Correia ignored his family background. His maternal grandfather, Manuel Rodrigues Serra, had taken the surname Porto from distant relatives, undoubtedly to avoid undesired Jewish connotations and trouble with the Inquisition. Correia adopted the same surname when he fled to London in 1795.

20 Correia da Serra received pensions from various parishes, all arranged by the Duque of Lafões.

21 ANTT, Manuscritos de Correia da Serra, B4-A.

22 Maratti was an opponent of the Linnaean sexual system. In his twenties, Correia da Serra corresponded with Linnaeus and mediated the introduction of Linnaean systematics in Rome; this occurred in 1774. The Swedish botanist was to express his deepest gratitude to Correia. However, later in his career Correia da Serra became critical of Linnaeus and preferred the natural method of classification due to Jussieu, a change that might be interpreted as a sign of his independent mind, given the prestige of Linnaeus throughout Europe. In effect, while in London, Correia da Serra was to criticize the Linnaean system and advocate Jussieu's at the partisan Linnean Society. Diogo *et al.*, *op. cit.* (note 13).

23 But not even as a Catholic priest did Correia da Serra escape from the tentacles of the Inquisitors. Despite his connections to the influential Joseph Banks, Correia da Serra felt threatened during his stay in London by the hostility of the Portuguese Ambassador and of the latter's nephew, a high dignitary of the Inquisition. Letter from Correia da Serra to Sir Joseph Banks, 10 August 1801, in *Banks Correspondence*, vol. 12 (*1800–1801*), DTC 12, pp. 244–250 (Natural History Museum, London).

24 In his work on the history of Freemasonry in Portugal, the historian Oliveira Marques mentions that Correia da Serra had been initiated into the Freemasons in Rome, belonging to the Lodge of 'Sincere Friends'. Marques also mentions the possibility of a Lodge christened 'Virtue I' being founded in Lisbon in 1794, to which Correia belonged. See A. H. O. Marques, *História da Maçonaria* (Palas Editores, Lisbon, 1979), vol. 2, pp. 145 and 498.

25 Diogo *et al.*, *op. cit.* (note 13); Simões *et al.*, *op. cit.* (note 8); A. Simões, A. Carneiro, M. P. Diogo, 'Building the Republic of Letters: the scientific travels of the Portuguese naturalist Correia da Serra (1751–1823)', *Rev. Mais. Fr.* **1**, 33–50 (2003).

26 We have two incidents in mind concerning his sexual behaviour. At about the time that Correia da Serra moved from Lisbon to London, he had also become involved in a delicate matter with the Inquisition. In 1793 he had signed a confession, in which 'to appease his conscience' he declared himself guilty of the practice of various acts of sodomy with men and women, identifying people and places. He begged for mercy and forgiveness, but he did not wait to see the result of his plea. ANTT, Inquisição de Lisboa, Nefando, Livro 145 (caderno 20), doc. 459; A. B. Coelho, *Inquisição de Évora: 1533–1668* (Editorial Caminho, Lisbon, 2002); F. Bettencourt, *História das Inquisições. Portugal, Espanha e Itália* (Círculo dos Leitores, Lisbon, 1994).

Later, when Correia da Serra moved to Paris, he fell in love with a woman named Esther Delavigne; she bore him a son, Eduardo José, who was legitimized shortly before his father's death. ANTT, Chancelaria D. João VI, Livro 28, fos. 62–62v. Lisbon, 4 February 1822, letter of legitimization of Eduardo José Corrêa da Serra. Although he took care of both Esther and their child, Correia da Serra was a Catholic priest who could not have a partner and son, and therefore only a group of selected friends knew of their existence. M. Teague, 'Kindred spirits: Thomas Jefferson and José Correia da Serra', *J. Am. Port. Soc.* (35th anniversary issue), 16–22 (1994); A.S. Carvalho, 'O Abade Correia da Serra', *Mem. Acad. Ciên. Lisbon* **6**, 7–223 (1948). When Correia da Serra moved to the USA, it seems that Jefferson was aware of his friend's 'secret', because in 1817 he insisted on da Serra's taking residence in Monticello before accommodating 'his wife and family' in the neighbourhood. Publicly, Eduardo José was introduced into the intellectual and political circles of Philadelphia first as Correia da Serra's nephew, and later as his secretary. R.B. Davis, *The Abbé Correia da Serra in America, 1812–1820: the contributions of the diplomat and the natural philosopher to the foundations of our national life* (American Philosophical Society, Providence, RI, 1993), p.71.

27 Simões *et al.*, *op. cit.* (note 25). Two years earlier he made a similar journey with Johan Jacob Ferber, and in 1776 he travelled again, this time accompanied by the Abbot Chaupuy.

28 ANTT, Manuscritos de Correia da Serra, A15. 'Journal d'une course en Avril 1774. Avec Mr. Demeste'. Transcribed in *José Correia da Serra, Itinerários Histórico-Naturais* (ed. A. Simões, A. Carneiro and M. P. Diogo), pp. 27–60 (Porto Editora, Porto, 2001).

29 Simões *et al.* (eds), *op. cit.* (note 28), p. 39.

30 ANTT, Manuscritos de Correia da Serra, A19, 'Observations d'Histoire Naturelle dans le Patrimoine de S. Pierre', 'Observações sobre a formação e estructura Fisica das tres Provincias Meridionais do nosso Reino' and 'Observações feitas em huma jornada pela provincia do Alentejo em Mayo e Junho de 1785'. Transcribed in Simões *et al.* (eds), *op. cit.* (note 28), pp. 61–66, 71–79 and 81–88.

31 ANTT, Manuscritos de Correia da Serra, A21, 'Observations faites en parcourant l'Espagne et le Portugal. Nº 1. Voyage de Cadiz a Serpa, 1777'. Transcribed in Simões *et al.* (eds), *op. cit.* (note 28), pp. 67–69. Michael Teague suggests that Correia da Serra interrupted this diary because of his father's death on 17 February. M. Teague, 'Textos Introdutórios', in *Abade J. C. Serra, documentos do seu arquivo* (*1751–1795*), p. 47 (FLAD, Lisbon, 1997).

32 Simões *et al.* (eds), *op. cit.* (note 28).

33 *Ibid*.

34 *Ibid*.

35 *Ibid*.

36 Buffon established the foundation of a geological system that deeply marked the eighteenth century, culminating in the publication of *Les Époques de la Nature* (1778). He formulated a Newtonian cosmogony, simultaneously avoiding theological controversy. When comparing Buffon's theory with the subsequent schools of thought, one is led to conclude that his theory was mixed: the hypothesis he formulated on the cooling of the Earth seems to link his theory to the Volcanist school, which claimed that the subterranean heat is the main agent of geological change. However, Buffon never explored this aspect of his theory, opting instead for the retreat of the ocean, thus establishing the basis of Neptunism, which Abraham Gottlob Werner was to develop. In the transition from eighteenth-century to nineteenth-century thinking, two geological theories competed: Neptunism, advocated by Werner, and Volcanism, initially suggested by Robert Hooke and converted into a general theory by James Hutton. Buffon's theory was later adopted by catastrophists such as Georges Cuvier. D. Oldroyd, *Thinking about the Earth: a history of ideas in geology* (Harvard University Press, Cambridge, MA, 1996), pp. 86–107; R. Laudan, *From mineralogy to geology. The foundations of a science, 1650–1830* (University of Chicago Press, 1987), pp. 87–112.

37 Within Volcanism, two alternative interpretations competed: a developmental approach and a steady-state world view. Catastrophism originated from the former; Uniformitarianism from the latter. P. J. Bowler, *Evolution. The history of an idea* (University of California Press, Berkeley, CA, 1989), pp. 35–49.

38 Another Volcanist whom Correia met in Italy was Alberto Fortis (1741–1803), who wrote a book entitled *Viaggio in Dalmazia* (Venice, 1774), which became very popular and was translated into various languages. L. Ciancio, 'Fortis, Alberto', in *Dizionario Biografico degli Italiani*, vol. 49 (dir. Mario Caravale), pp. 205–210 (Istituto della Enciclopedia italiana, Roma, 1997) and L. Ciancio, *Autopsie della Terra. Illuminismo e geologia in Alberto Fortis (1741–1803)* (Leo S. Olschki, Florence, 1995).

39 ANTT, Manuscritos de Correia da Serra, A19, 'Observações feitas em huma jornada pela provincia do Alentejo em Mayo e Junho de 1785'. Transcribed in Simões *et al.* (eds), *op. cit.* (note 28).

40 Simões *et al.* (eds), *op. cit.* (note 28).

41 J. C. Serra, 'On a Submarine Forest on the East Coast of England', *Phil. Trans. R. Soc. Lond.* **89**, 145–156 (1799). Reprinted in Simões *et al.* (eds), *op. cit.* (note 28).

42 Correia da Serra reiterates that 'in geology, perhaps more than in any other branch of natural history, it is absolutely necessary to separate observed facts from ideas which might come to

the mind of the observer to explain them'; in Serra, *op. cit.* (note 41). Reprinted in Simões *et al.* (eds), *op. cit.* (note 28).

43 Simões *et al.* (eds), *op. cit.* (note 28).

44 Serra, *op. cit.* (note 41). Reprinted in Simões *et al.* (eds), *op. cit.* (note 28).

45 This comment is written by Correia da Serra in a piece on Teodoro de Almeida in *Biographie Universelle ancienne et moderne* (ed. J. Michaud and L. G. Michaud) (Chez Madame C. Desplaces, Paris, 1843–65), vol. 1, p. 507.

46 K. Maxwell, *Naked tropics. Essays and other rogues* (Routledge, New York, 2003), p. 177.

47 F. Catroga, 'Os Caminhos Polémicos da "Geração Nova"', in *História de Portugal. O liberalismo* (*1807–1890*) (ed. J. Matoso, L. R. Torgal and J. L. Roque), vol. 5, pp. 482–514 (Editorial Estampa, Lisbon, 1998).

48 O. Chadwick, *The secularization of the European mind in the 19th century* (Cambridge University Press, 1975), pp. 45–47.

49 Chadwick, *op. cit.* (note 48).

50 Richard G. Olson, *From Copernicus to Darwin. Science and religion, 1450–1900* (Johns Hopkins University Press, Baltimore, MD, 2004), pp. 155–156.

51 Olson, *op. cit.* (note 50).

52 The '1870 Generation' was a movement that originated in Coimbra, gathering together renowned young Portuguese intellectuals who engaged in the renovation of Portuguese culture and society, from politics to literature.

53 V. Leitão, 'The travel of the geologist Carlos Ribeiro (1813–1882) in Europe, in 1858', *Comun. Inst. Geol. Min.* **88**, 293–300 (2001).

54 Delgado wrote to his fellow Spanish archaeologist Francisco M. Tubino (1833–88), telling him how he and Ribeiro became interested in archaeology and palaeoanthropology. Letter from Nery Delgado to Tubino, 23 July 1869, National Laboratory of Energy and Geology Historical Archive (hereafter LNEGHA).

55 Perthes's findings dated from about 500 000 years and were ascribed to Neanderthal populations, although some experts think they dated from about 1 000 000 years; that is, they were associated with *Homo erectus*.

56 Carlos Ribeiro, 'Les Kioekkenmoeddings de la Vallée du Tage', in *Compte Rendu de la 9e Session du Congrès international d'anthropologie et d'archéologie préhistoriques, 1880*, pp. 279–291 (Academia Real das Ciências, Lisbon, 1884).

57 *Compte Rendu de la 9e Session du Congrès international d'anthropologie et d'archéologie préhistoriques, 1880* (Academia Real das Ciências, Lisbon, 1884).

58 J. L. Cardoso, 'As investigações de Carlos Ribeiro e de Nery Delgado sobre o "Homem do Terciário": resultados e consequências na época e para além dela', *Ests. Arque. Oeiras* **8**, 33–54 (1999–2000).

59 Charles Darwin published *The Descent of Man, and Selection in Relation to Sex* in 1871, in which he discussed the origin of Man.

60 A. L. Pereira, *Darwin em Portugal* (*1865–1914*). *Filosofia, história, engenharia social* (Almedina, Coimbra, 2001); C. Almaça, *O Darwinismo na universidade Portuguesa* (*1865–1890*) (Museu Bocage, Museu Nacional de História Natural, Lisbon, 1999).

61 Pereira, *op. cit.* (note 60), and Almaça, *op. cit.*(note 60).

62 Also known as Tinop, he was a kind of archaeologist of a typical social type in Lisbon.

63 *Compte Rendu du Congrès International d'Anthropologie & D'Archéologie Préhistorique* (C. Muquardt, Brussels, 1873).

64 LNEGHA, File 9, Box 1, Shelf 1, Bookcase 1.

65 Chadwick, *op. cit.* (note 48).

66 Among them were Emile Carthaillac, Juan Villanova, Quatrefages, the young Marcellin Boule, Hans Hildebrand and the Baron of Baye.

67 Cardoso, *op. cit.* (note 58).

68 *O António Maria* (30 September), 318 (1880). The newspaper was called António Maria after the first names of Fontes Pereira de Melo, and with the obvious intention of satirizing him and what he represented.
69 J. Mattoso and R. Ramos (eds), *História de Portugal. A segunda fundação* (1890–1926) (Editorial Estampa, Lisbon, 2001), vol. 6, pp. 352–355.
70 On liberalism and religion see Mattoso and Ramos, *op. cit.* (note 69).
71 *Ibid*.
72 M. B. Cruz, 'As origens da democracia Cristã e o Salazarismo', *Anál. Social* **54**, 265–278 (1978).
73 A. H. O. Marques, *História de Portugal* (Palas Editores, Lisbon, 1977), vol. 2, p. 308.
74 The Concordat did not put an end to civil matrimony or divorce, and cemeteries were not consecrated, for example; Marques, *op. cit.* (note 73).
75 The relationship between scientific practice and religion, and the ideal of the natural philosopher/scientist as a saint can be traced back to the so-called 'Scientific Revolution'. See S. Shapin, *The scientific revolution* (University of Chicago Press, 1996), pp. 144–162; J. R. G. Turner, 'The history of science and the working scientist', in *Companion to the history of modern science* (ed. R. C. Olby), pp. 23–46 (Routledge, London, 1996). Daston and Galison propose a different approach. For them, the concept of objectivity in science is closely intertwined with moral aspects linked to scientists' self-discipline, making them look like saints: L. Daston and P. Galison, 'The image of objectivity', *Representations* **40**, 81–128 (1992); P. Galison, 'Judgement against objectivity', in *Picturing science, producing art* (ed. C. Jones and P. Galison), pp. 327– 359 (Routledge, London, 1998). Daston also finds similarities between the attitude of scientists towards epistemology and that of the devout towards religion: L. Daston, 'Scientific error and the ethos of belief', *Social Res.* **72**, 1–28 (2005).
76 F. Gonçalves, 'Notícia bio-bibliográfica sobre Carlos Teixeira', *Bol. Soc. Port. Ciên. Nat.* **22**, 85–90 (1984/85); F. Gonçalves, *Carlos Teixeira, notícia bio-bibliográfica, o pedagogo, o cientista* (Lisbon, 1976).
77 Carlos Teixeira initially wished to study medicine but because of the length of the degree—six years—he chose a licence in historical-natural sciences, which took only four years. Teixeira's financial situation forced him to make this choice. Gonçalves, *op. cit.* (note 76).
78 Gonçalves, *op. cit.* (note 76).
79 *Ibid.*
80 *Ibid.*
81 *Enciclopédia Portuguesa e Brasileira* (Editorial Enciclopédia Lda., Lisbon, n.d.), vol. 16, pp. 881–883; *Verbo Enciclopédia Luso-Brasileira da Cultura* (Editorial Verbo, Lisbon, n.d.), vol. 6, pp. 4–5.
82 Simões *et al.*, *op. cit.* (note 8).
83 Carlos Teixeira's best marks while he was at university were in biology and botany: Carlos Teixeira's curriculum vitae, LNEGHA, Box Carlos Teixeira, Shelf 3, Bookcase 24.
84 C. Teixeira, 'O antrocolítico continental Português (estratigrafia-tectónica)', *Bol. Soc. Geol. Port.* **5**, 1–139 (1945).
85 He coordinated the fourth edition of the Geological Map of Portugal at the scale of 1:500 000, released in 1972.
86 C. Teixeira, 'Professor Doutor J. Carrington da Costa', in *Estudos Científicos Oferecidos em Homenagem ao Professor Doutor J. Carrington da Costa* (JICU, Lisbon, 1962), pp. IX–XXVII.
87 See, for example, Carlos Teixeira, 'Vegetais fósseis do grés do Quilungo', *An. Junta Miss. Geogr. Invest. Coloniais* **2**, 85–92 (1948); C. Teixeira, 'Geologia das ilhas de S. Tomé e do Príncipe e do território de S. João Baptista de Ajudá', *An. Junta Miss. Geogr. Invest. Coloniais* **2**, 2 (1949).
88 For detailed information on Teixeira's bibliography see G. Zbyszewski and F. Gonçalves, 'Carlos Teixeira', *Comun. Serv. Geol. Port.* **69**, 177–198 (1983); O. Ribeiro, 'A personalidade de Carlos Teixeira', in *O. Ribeiro, Opúsculos Geográficos* (Fundação Calouste

Gulbenkian, Lisbon, 1989), vol. 1, pp. 307–313; Gonçalves, *op. cit.* (note 76); *Memórias de Professores Cientistas. Os 90 anos da FCUL, 1911–2001* (ed. A. Simões) (Lisbon: FCUL, 2001), pp. 91–95.

89 C. Teixeira, *A paleontologia e a origem do homem* (published by the author, Lisbon, 1967).

90 Teixeira, *op. cit.* (note 89).

91 Gonçalves, *op. cit.* (note 76).

92 Zbyszewski and Gonçalves, *op. cit.* (note 88), and Ribeiro, *op. cit.* (note 88).

93 Nowadays, people close to Carlos Teixeira assume that he was, in fact, the son of the priest and not his nephew.

94 The few personal documents left by Carlos Teixeira do not give any information about his religious practices, nor the recollections of his close friends and former students. LNEGHA Box Carlos Teixeira, Shelf 3, Bookcase 24.

95 On the moral values preached by the Portuguese dictatorship see M. F. Mónica, *Educação e sociedade no Portugal de Salazar* (Editorial Presença, Lisbon, 1978); *Dicionário de história do Estado Novo* (ed. F. Rosas and J. M. B. Brito) (Bertrand Editores, Lisbon, 1996) (2 volumes); *História de Portugal. O Estado Novo* (*1926–1974*) (ed. J. Mattoso and F. Rosas) (Editorial Estampa, Lisbon, 1994); *O Estado Novo—das origens ao fim da autarcia (1926–1959)* (ed. A. C. Pinto) (Editorial Fragmentos, Lisbon, 1987) (2 volumes); R. Grácio, *Obra Completa* (Fundação Calouste Gulbenkian, Lisbon, 1995) (3 volumes).

96 A Swiss geologist who worked for the Portuguese Geological Survey between 1878 and 1919, his work became a landmark.

97 Teixeira, *op. cit.* (note 88).

98 Teixeira's friend Orlando Ribeiro, who had troubles with the Portuguese dictatorship, stated that Teixeira was politically uncompromised. Teixeira, *op. cit.* (note 88). One of Teixeira's former students, António Ribeiro, mentioned that Teixeira was willing to give him refuge when he (Ribeiro) was being persecuted by the political police. Teixeira, *op. cit.* (note 88).

99 See *Science, technology, and national socialism* (ed. M. Rennenberg and M. Walker) (Cambridge University Press, 1994); *Germany's nature: cultural landscapes and environmental history* (ed. T. M. Lekan and T. Zeller) (Rutgers University Press, Piscataway, NJ, 2005).