Earthquakes and the Coming of a Age of a Scientific Attitude in Portugal (1755-1791)

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- *International Conference - 250Th Anniversary of the 1755 Lisbon Earthquake, Proceedings,* p. 76-79 .

ABSTRACT

During the Enlightenment when in Europe rationalist optimism avowed the importance of science and technique to human happiness, the great 1755 Lisbon earthquake troubled human consciousness, brought fear and installed doubt. We can say that its mental consequences were devastating. In this context, the affirmation of a scientific mentality in Portugal had an important reference in the work of Ribeiro Sanches, *Tratado da Conservaçam da Saude dos Povos* (1757). This Portuguese scientist published his work after the earthquake. In there he made an inquiry of the most violent earthquakes in history. Ribeiro Sanches ideas had a remarkable influence on the Portuguese intellectual elite, namely to the necessity of asking about the phenomena real causes. He abandoned the traditional moral explanations such as the "violent passions", " the dissolute life" and other of this kind.

In the present paper we will analyse the quarrel between two mentalities towards earthquakes: the traditional and the scientific. The traditional saw earthquakes as a divine punishment, arguing that men should pray to prevent this kind of disasters, while the scientific considered earthquakes as natural observable facts that could be eventually explained according to natural causes.

We take as base some texts about the earthquake of Lisbon; especially the letters of D. Manuel do Cenáculo, where we can find accounts about the 1755 Lisbon earthquake and also the 1791 earthquake that took place in Southern Portugal.

1- A new interpretation of natural phenomena

The affirmation of a scientific attitude in 18th century in Portugal should not be regarded as merely the result of the clash of ideas between purists and those influenced by scientists abroad – the former "traditionalists" and the latter "modernists"; while the influence of the new scientific paradigm is clearly evident in the ideas of the modernists: men like Ribeiro Sanches, Jacob de Castro Sarmento and Luís António Verney, many traditionalists also looked to a new method and new masters. A good example of a member of the latter group is Bento Farinha, professor of Philosophy in the Pombaline era, who looked to contemporary physicists for guidance and abandoned the scholastic method, thus following in the steps of António Genovesi, Mossenbroerk and Gravesande. Similarly, the writings of such individuals as bishops Caetano Brandão and Manuel do Cenáculo reveal that they were well-informed about the scientific theories of the day and that their attitude towards natural phenomena was to seek to determine the rational causes for their occurrence. However, this did not mean that such men gave up their faith or their belief in miracles and divine intervention[1].

According to Manuel do Cenáculo, the Bishop of Beja, there is a natural relationship between Religion and Science: those who seek to explain natural phenomena are not necessarily forced to abandon their faith, for God created Nature and this is reflected in the greatness of the Creator; so Science actually aids Faith. Science and Religion represent two levels of knowledge, the former achieved by means of observation and experience, and the latter through revelation: there is the plane of faith and miracles, and there is the plane of the physical world of phenomena whose causes are determined by certain laws. It is these ideas that Cenáculo defends in his writings, and especially in a circular letter to the members of his diocese bearing the heading *Estudos Físicos do Clero* (Physical Studies by the Clergy)[2].

The idea of nature in Cenáculo's works and the importance assigned to Science and Technique were dealt with in a previous paper[3]. The study of the physical world, Natural History, or the works of God, brings three great advantages for the ecclesiastic: it enables him to get closer to God, to combat popular superstition (as it distinguishes miracles from phenomena with natural causes)[4] and, in the words of the bishop, "a member of the lower orders, who has only learnt about Nature through his practical dealings and with no learning, who observes the educated ecclesiastic, with all his erudition, will not hesitate to ask him for his resolutions or measures as regards improving farming methods and his opinions on the cause of things,"[5].

The notion of "resolutions" or "measures", which appears in Cenáculo's other writings, is an important one. They represent actions by which Man "aids Nature", that is, undertakings which enable Man to perfect natural works: these would include pruning, employing new techniques, and draining marshes. This idea is in accordance with the thought of the Cambridge Neoplatonists, Ralph Cudworth and Henry More, as well as that of António Genovesi. According to Genovesi, it is not Man's duty to fashion nature, but he can and indeed should rule over it. Cenáculo's measures can be summed up as scientific and technical knowledge that men should develop in the search for prosperity and well-being[6].

The scientific attitude as a means of combating popular superstition is present in Cenáculo's pastoral and diocesan circular letters, and even in procedures and sacred proceedings, such as the examination of individuals with a view to the bestowing of sainthood, and the burying of the dead. In the former case, Cenáculo, like his fellow bishops, was at times forced to combat popular superstition, which led to great demand for relics following the death of any "saintly figure": many were those who sought to acquire some small bodily remains in order to ward off evil[7]. Regarding the burying of the dead in churches, the bishop expressed his ideas in a letter dated 29th August 1780 to the Mother Superior of the Carmelite

Convent; he begins by referring to the inconvenience which derived from interring corpses in the lower chancel, which was exacerbated by the summer heat; he notes that in previous times customs had been different and the result more salutary, but because of the wars with the barbarians these had been neglected[8]. He describes the problem of the decomposition of corpses and its harmful effects, the danger of infection and the spread of disease, which "requires a preservative remedy"[9]. For this reason, he decides to call a halt to burials in church chancels, and thenceforth chapter houses were used for this purpose, because as he states: "the chapter house is situated in the part of the building which receives fresh air from the cloisters"[10]. As an enlightened individual, Cenáculo felt obliged to denounce and combat what he saw as an anti-scientific and even anti-rational practice, but as a practicing bishop and man of the Church the practical measures he decided on would have to involve compromise.

One author who definitely contributed towards the affirmation of the scientific attitude in Portugal was Ribeiro Sanches. His writings reveal, however, a more distinct separation between religion and science, or rather between the responsibility of the ecclesiastical authorities as regards the question of Faith and what he sees as the responsibility of the State as regards the question of the dissemination of scientific knowledge. In his work entitled *Cartas sobre a educação da mocidade* (Letters on the Education of Young People, 1760) he denounces the intrusion of the Church into certain areas of science and the resulting confusion between scientific discovery and heresy. He even accuses the Jesuits of fomenting this confusion and using it to their advantage, and thus applauds their expulsion:

> "Thank God I have lived long enough to receive the news that the priests of the Company of Jesus are no longer Confessors or Masters; for if they had been allowed to continue in such offices, which they have held for so long, all the truths which can be read in this paper would be regarded as nothing more than heresy!"[11]

Sanches argues strongly in favour of the secularisation of education and science: it is up to the sovereign to create schools teaching science. Thus, ecclesiastical authority in this field is regarded as pernicious as far as the interests of the civil state and even religion itself are concerned.[12] This secularising spirit becomes more pronounced with the appearance of *Tratado da Conservaçam da saude dos povos* (Treatise on the Preservation of Popular Health); in it Ribeiro Sanches refers to recent studies carried out by chemists, such as Herman Boerhaave, scientists who contributed to the Memories of the Paris Academy, architects such as Leon Baptista Alberti, and the example of the Greeks and Romans, arguing in favour of the "preservation of the health of the common people", which in his opinion dependent on natural factors: fresh air, clean water and hygiene in cities and streets.

> "Every day we complain of so many chronic diseases, so many sudden deaths, such are evident in the cities, and sometimes blame luxury, sometimes dissolute lifestyles and especially violent passion, but never we think to attribute the cause of these evils to the infected and corrupt air that we constantly breathe in our cities. I am convinced that if any Magistrate should understand their cause, he will introduce laws to ensure by every possible means that cities are kept clean[13]."

Sanches' message is very clear: traditional moral explanations for phenomena should be abandoned, and their natural causes should be observed. He also made an attempt here to separate questions of Faith and questions of Science. This was doubtless a breath of fresh air which began to sweep away the stuffiness accumulated over the centuries.

The insistence on fresh air as a factor in improving health is clearly evident in the works of a number of writers including Luís Verney, who strongly encouraged the airing of hospitals, Manuel do Cenáculo, who likewise advocated well-aired religious houses, and José António de Sá, who insisted on the circulation of air in prisons[14].

But with earthquakes the question was hardly limited to the mere circulation of air. The phenomenon was much more complex and obscure in its causes, even for the scientific community. In this field, the work of Ribeiro Sanches was also greatly influential: he strongly advocated the need for the study, observation and description of earthquakes; he himself also set an example by setting out in the appendix to his work entitled *Consideraçõens sobre os terremotos* (Considerations on Earthquakes)[15] an inventory of the most important such occurrences; and besides this he set out guidelines for the construction of buildings with a view to the prevention of earthquake damage.

Let us briefly examine the analysis carried out by Sanches in this work in an attempt to gain an understanding of how a scientific attitude is established in the text. We sense such an attitude from the references to and quotes from writers who were regarded as authorities in the field, ranging from traditional classical writers such as Aristotle, Seneca and Pliny to figures of the modern age such as Newton and the scientists of the Paris Royal Academy of Sciences.

Sanches' message could not be clearer: traditional explanations were to be abandoned and earthquakes should be treated just like any other physical phenomenon:

> "... if we knew as much about the cause of Earthquakes as we know about the cause of wind and thunder then neither would we probably treat these notable phenomena of Nature as a form of punishment from Heaven nor would we see in them the foreboding of our total ruin[16]."

The illustrious doctor also has recourse to the past in order to explain the phenomenon. He presents a succinct account of some great earthquakes occurring throughout history enabling him to draw scientific conclusions as to where the phenomenon is most likely to occur[17]. It should be mentioned that the assumptions on which Sanches bases his scientific explanation for earthquakes are in accordance with the theories in vogue in the era, which assign the cause to volcanic activity and the "force of trapped air" or the "force of steam and exhalations out of the interior of the earth".[18]

This scientific stance would also be assumed by Manuel do Cenáculo years later, in 1791, when the south of the country was hit by an earthquake; although its social and economic impact was far less far-reaching than that of the earthquake of 1755, as is usual with earthquakes the 1791 quake caused widespread panic among the population. Cenáculo's efforts to learn about the details of the phenomenon from the scientific

community and the explanations provided by contemporary academics are described in our previous study; the documents cited in this paper provide evidence for the affirmation of a scientific attitude, while the role of religion is not disregarded[19].

2- Reports of the 1755 Lisbon earthquake

It is a well-known fact that the earthquake of 1755 had an enormous impact on European public opinion. The Lisbon disaster naturally provided an issue for lively discussion in the press and most reports were targeted either at the educated or the inquisitive. Despite the wealth of material published, much of it was of little worth, as is recognised by some contemporary commentators[20]; meanwhile, it seems significant that the disaster was used to stimulate the ideological debate (which had strong political overtones) which had been going on within the Church for a long time; there were also some who saw in the earthquake a great opportunity for doing business and combating economic competition from the great powers: France and England.

Looking firstly at the debate within the Church, Jansenist forces used the earthquake to attack both the Company of Jesus and the more puritan sections of the Church in a report written in 1756-1757. The principal message of this voluminous document is that the earthquake was divine punishment meted out to Lisbon and that the main reason for God punishing Portugal was the fact that it had been the first country to welcome the Jesuits and had also provided the stage on which the horrors of the Inquisition were played out:

> "Portugal was not only the bloody stage of the hateful Inquisition but also provided the cradle for a Society which soon failed to live up to the august name which it had been given (...) Lisbon was the first place where the Jesuits were welcomed, and so it is the first place that God now punishes[21]."

In another account, also published anonymously in French, the central theme is the advantages that France was likely to draw from the catastrophe and the great opportunity afforded to Portugal for freeing itself from the English yoke, which stifled its economy and reduced the country to the status of a British colony. The argument of this document is dominated by the economic interests of France and opposition to the commercial interests of England and therefore the introduction is much longer than the account of the earthquake itself. The description which is given of Portugal is that of a country dominated by superstition and by England[22].

The most radical suggestion[23] was that that the earthquake might well contribute towards the liberation of Portugal and also the establishment of a new balance of power in the European economy. It was proposed that Portuguese commerce should be divided up among the great powers; that is, the anonymous writer thinks that the best thing for Portugal and the Portuguese people is that its trade, particularly the colonial trade, should be opened up to France, Italy and Germany. He is therefore firmly against British domination.[24]

It also seems relevant to stress another aspect of this relationship of an "economic" nature: the affirmation of a quantitative, even statistical, approach. The anonymous author takes the trouble to draw up an inventory of the damage caused by the earthquake. He regards it as impossible to give the exact number of deaths, as there was no population census. He refutes exaggerated reports, such as those of "foreign Ministers", indicating a figure of 100,000 deaths, insisting this is an overestimation: because these people had been directly caught up in the event they had been unduly influenced by the terror and panic[25]. Due to a lack of sources and credible evidence, the writer refuses to hazard a guess at a figure for the number of deaths, although he informs us that the most occurred among church congregations[26].

This concern with quantification is also evident in the inventory and calculation, in terms of contemporary monetary values, of the cost of damage to buildings. On the list of buildings which were badly damaged appear: the royal palace, the bishop's palace, the customs house, seven Jesuit buildings, the headquarters of the Inquisition, parish churches, monasteries and convents; total losses to public buildings are calculated at ten million *cruzados*, or the equivalent of 25 million Tournois pounds.

Table 1. Losses caused by the 1755 Lisbon earthquake

Losses	Value (Tournois pounds)
Public buildings	25,000,000
Private houses	700,000,000
Moveable assets burnt	200,000,000
Money losses	25,000,000
Diamonds	50,000,000
Marble works, statues and pictures	32,000,000
English goods	160,000,000
French goods	4,000,000
Hamburg goods	40,000,000
Italian goods	25,000,000
Dutch goods	10,000,000
Swedish goods	3,000,000
German goods	2,000,000
Total Losses	1,276,000,000

(Source: Anonymous 1756, p. 190)

Although these numbers may well have been exaggerated in keeping with the sensationalism of this type of publication, aimed as it was at satisfying the keen public demand for news, and although they are mere estimates for which no source references are given[27], they nevertheless give an indication of the enormity of the tragedy and how it was received abroad.

Another relevant piece of evidence is a letter dated 11th December 1755 from the Hamburg Senate to the Portuguese King; as the above table shows, Hamburg was one of the international communities hardest hit by the earthquake. The document also demonstrates that a degree of solidarity was shown by people in other countries in response to the catastrophe and that, just as is true nowadays, in the past, when a disaster of such magnitude occurred, people's overriding concern was for their fellow countrymen.

The letter demonstrates the religious spirit referred to above: the earthquake was regarded as divine punishment. As regards solidarity, the letter provides an understanding of the impact caused by the earthquake, the interest shown in making generous donations, and the concern to safeguard the property owned by businessmen and other citizens of Hamburg. The text of the letter, and which appears in the appendix, provides details of the donations sent: four ship-loads of building materials of different types[28].

3- Final Considerations

The impact of the earthquake of 1755 on public opinion was immense. The reports which have survived show a diversity of interpretations of the event and interests surrounding it, from the way it was used by the Jansenists for attacking the Jesuits to its exploitation in support of the economic interests of other European countries, while there is also the impact felt in terms of literary creation and the history of the book. With regard to the latter, an inventory containing all the reports and accounts of the event has yet to be drawn up, and such an initiative would be likely to bring to light much new evidence, both printed and manuscript.

Both the earthquake of 1755 and that of 1791 aroused the interest of Portuguese intellectual elites in the phenomenon and the attempt to discover a scientific explanation for it. For many, this search in no way called into question the belief that God is the Lord of Nature, time and Man's destiny. This continued to be the conventional wisdom as expressed both in official discourse and by the popular mind. The novelty of the new spirit lies more in the way new laws governing phenomena were obeyed and defended rather than in any search for such new laws, and in an increased interest in reading about and discovering Nature, and in no way goes against divine design. It is this Newtonian interpretation, or even that of a moral Newtonianism, which is gradually affirmed and which does not admit of an irresolvable dispute involving religion and science.

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[1] - On this clash of ideas, see VAZ, 2002.
[2] - CENÁCULO, 1786.
[3] - VAZ, 2001.
[4] - "The peasant is superstitious and unthinkingly or maliciously abuses creatures, thinking mystery, which is Nature, is in them". CENÁCULO, 1786, p. 7. The spelling of all quotations has been modernised, although the titles have been preserved as they originally appeared.
[5] - Op. cit. p. 7.
[6] - As Cenáculo says, the ecclesiastic who is educated in Natural History knows how aid can be afforded to "nature by means of measures: in this way the virtues of plants are unencumbered by that which would weaken or destroy them and manual labour is eased by the introduction of ingenious machines. These are the great advantages of such measures: they get of idleness, cheer the disconsolate and sustain families", CENÁCULO, 1786, p. 8.
[7] - Cf. VAZ, 2002, p.271-272.
[8] - "and very hygienic proceedings were carried out in this respect". Public Library of Évora, Cod. CXXVII/1-13, 1781, fl. 80. "and ignorance which easily spreads in disorderly times was the cause of the neglect of ancient rites". Idem, ibidem.
[9] - Idem, ibidem.
[10] - Idem, fl. 80v.
[11] - SANCHES, 1959, p. 223,(First edition 1760.
[12] - "May His Majesty be the Sovereign Lord who founds universities and schools in which the natural sciences may be taught: civil institutions, which are not dependent on any principle of ecclesiastical authority". Idem, p.259.
[13] - SANCHES, 1757, p. 100. It should be noted, however, that as regards sewers the overriding concern, in accordance with the advice of Léon Baptista Alberti, was "that sluice-gates should always be positioned higher than the level of the rivers, the sea, and the valleys into which they flow, for otherwise the filth will flow back and great damage will be caused to the sluices." Idem, p. 98.
[14] - On this theme, see a previous study, VAZ, 2002.
[15] - SANCHES, 1959. Vol. II, p. 365-391.
[16] - Op. cit. p. 366.
[17] - SANCHES, 1959, op. cit, , p. 367.
[18] - "It is also certain that in the interior of the earth there exists fire, which we know by the sensation of heat, which increases its activity the deeper one penetrates underground" SANCHES, op. cit. p. 378.
[19] - VAZ, 2001. Documents dealing with the earthquake of 1791 are transcribed in the appendix. See also: Public Library of Évora, Cod. CXXIX/1-20, (Diary of D. Manuel do Cenáculo), 1789-1793, fls. 209-211v.

[20] - Friar Manuel do Cenáculo provides evidence for this in a letter to Buitrago in which he mentions that he has sent him some accounts of the earthquake – only those of a high standard: "... I will send the best accounts of the earthquake from among the many which have been published: I will not send them all, as my good taste will not allow it". Public Library of Évora, Cod. CXXVIII/2-9, 1757, np.
[21] - ANONYMOUS, 1756-1757, p. 83.
[22] - ANONYMOUS, 1756. Also cited are Voltaire, p. 4, and Montesquieu, p. 21, the latter for the purpose of comparing Portugal with the barbarous nations.
[23] - "Politics is not the only cause of Revolutions in States; disasters also change the face of Empires". Op. cit. p. 1.
[24] - "This trade should be shared out among Germany, Italy, France and England. And all nations will be at peace, and a wise balance of power will hold". Idem, p. 180.
[25] - Op. cit. p. 194.
[26] - Op. cit. p. 195
[27] - Having arrived at a final total, the writer himself admits that this is an approximate figure.
[28] - Public Library of Évora, Cod. COD. CV/1-5, *Miscelanea*, 1755, fls. 169-173.

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