GREAT LISBON 1755 ANTIPODAL IMPACT QUAKE

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Abstract. *The great Lisbon earthquake Nov. 1, 1755 devastated the city and Portuguese coastlines down to Morocco. Many details of the event are typical signs of chaotic terrane caused by an antipodal impact. A faint but fresh-looking antipodal impact structure centered at 35°39'S, 168°26'E is found in the Tasman Sea, or about 405 km WSW of Cape Reinga, North Island, NZ. By conventional geological methods, the epicenter has been inferred to be on the bottom of the Atlantic Ocean, in an area known as the Horseshoe Plain WSW of Cape St. Vincent, Portugal, at a distance of about 200 km from the cape, a round figure estimate. The impact antipode at 35°39'N, 11°34'W also is located in the Horseshoe Plain at 277 km WSW of Cape St. Vincent, the implied antipodal impact quake epicenter.*

Keywords and phrases: *Cosmic object impacts, antipodal chaotic terrane, Lisbon 1755 devastating earthquake, New Madrid 1811, Budapest 1578, Eltanin impact 2.588 Ma, onset of Pleistocene.*

Introduction: Discerning Antipodal Impact Quakes.

Among topics in Earth & Planetary Science that have not received much attention, despite some recently achieved progress in the general area of cosmic object impacts (1, 2, 3), here in this paper I emphasize discovery of which known earthquakes were caused by antipodal impacts of a comet or asteroid. The impact quake seismic wave travels around the globe and then is refocused at the antipode, possibly causing tremendous damage, called a chaotic terrane. We might see the ground opening up, emitting vapors & engulfing large structures, sand fountains squirting sand, even granitic plutons erupting, driven up from the ``Moho," the Mohorovicic partially molten zone between crust & mantle. Known examples exist, one on planet Mercury. But so far, geologists largely seem to have overlooked such signs. There are three fairly recent examples, in historical times, where reports clearly convey the diagnostic symptoms of chaotic terrane.

1. New Madrid, Dec. 16, 1811

2. Lisbon, Nov 1, 1755

3. Budapest, May 19, 1578

Of course, antipodal impact quakes are numerous in prehistory. For just one example, the Eltanin impact 2.588 Ma in the Bellingshausen Sea (W of Cape Horn) has antipodal granitic plutons near Krasnoyarsk, Siberia, known as the ``Stolby Nature Preserve", popular with local rock climbers. The impact was discovered by Frank Kyte, using piston cores from research ship ``Eltanin" (MS thesis, UCLA, 1977). The date of 2.588 Ma, or about two and a half million years ago, marks the official onset of the Pleistocene, established by the international geological governing body.

In many cases it is easy to identify the antipodal structures, thanks to satellite images (Google Earth). However, these are mostly low-resolution, inferred indirectly from gravity measurements, except along tracks where research vessels have taken high precision soundings. You can see these tracks criss-crossing Google Earth maps in many places. Moreover, there has been no concerted effort to study the formation of ocean bottom craters, which involve mudflows instead of and probably very different from subaerial ejecta.

1. Discovering the Lisbon 1755 Epicenter & Antipodal Impact Signature.

For the great Lisbon earthquake Nov. 1, 1755, that devastated the city and Portuguese coastlines down to Morocco, many reported details of the event are typical signs of chaotic terrane caused by an antipodal impact.

It took me 15 years to find the impact, the impression is so subtle, located in the Tasman Sea between Australla & New Zealand, its center 405 km WSW of Cape Reinga, which is the extreme NW corner of North Island, NZ. It may be difficult to perceive the faint outline in Figure 1. The 120 km yellow line is a diameter of the ``crater," a fresh-looking nearly circular rim, presumably left by some kind of mudflow set off by the impact explosion. Cape Reinga is on the right-hand margin of the image.

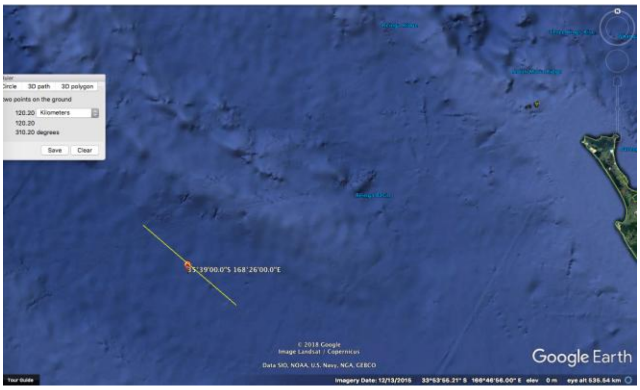

Fig. 1. *Lisbon antipodal impact signature, Tasman Sea. Contour outline faintly recognizable. Yellow 120 km line indicates structure diameter. Center map coordinates 35°39'S, 168°26'E. Google Earth image/own work.*

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Captain James Cook learned about the impact with feu du ciel from the Maori of NZ. He had a Polynesian interpreter from Tahiti on board, Tupaia, a navigator who could draw a map of all the Polynesian islands in the Pacific. When Captain Cook arrived in the Tasman Sea in 1769, he mapped the entire coast of NZ for the first time. He landed at Botany Bay, near Sydney, in 1770, where the Aborigines reported the fiery impact event of only 15 years before.

Here, I am reporting a personal communication, that I received in the past, 15 years ago, from Ted Bryant, Wollongong University, well-known author of his book about impact tsunami, now Dean of Science, but am unable to confirm details about Captain Cook exchanging information with native inhabitants of either continent.

The impact coordinates of 35°39'S, 168°26'E give us its antipode at 35°39'N, 11°34'W, shown in Figure 2 below at right, which should be the epicenter of the chaotic terrane.

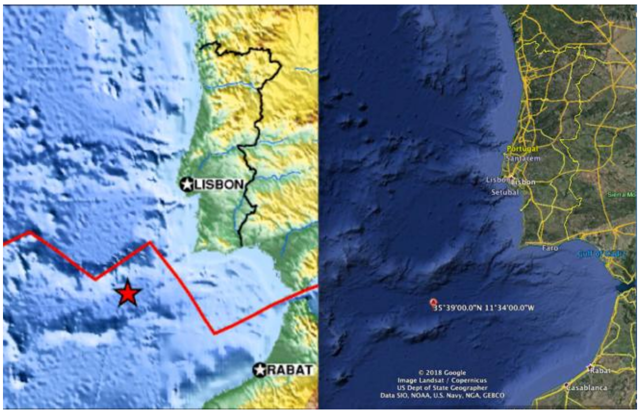

Fig. 2. *Left, map showing conventionally inferred location of epicenter of Lisbon 1755 in the Horseshoe Plain. Map from Wikipedia. Right, implied epicenter at 35°39'N, 11°34'W based on antipodal impact site in the Tasman Sea. Google Earth image/own work.*

The impact antipode is located WSW of Cape St. Vincent, the ``chin" of Portugal on the abyssal bottom of the Atlantic Ocean, in a valley known as the Horseshoe Plain. At left is a map from Wikipedia, showing the inferred location of the epicenter found by geologists also in the Horseshoe Plain, determined by numerous researchers working over decades, even centuries, using conventional methods of three kinds (4, 5, 6):

1. Historical records of widespread devastation along the coasts of Portugal and Morocco, quake & tsunami arrival times, hours and minutes.

2. Precise measurement of seismic signal velocities by modern methods in the entire region.

3. Ocean bottom disturbances of strata mapped in detail, finding these in the Horseshoe Plain.

The estimate found by this bare-hands approach-ignoring the antipode-was for the epicenter to be WSW of Cape St. Vincent by about 200 km, a round figure estimate.

The antipodal impact epicenter in the right hand map, @ 35°39'N, 11°34'W, is about 277 km from the cape, a little further WSW down the Horseshoe Plain.

Summary & Conclusion:

Random Cosmic Encounter Determined Fate Of A City.

Now that the true cause of the horrific Lisbon 1755 quake is known, an antipodal impact in the Tasman Sea, for the Portuguese there remains some kind of absurd consolation, the freak accident of a comet coming down on the other side of the globe, the futility of fate, a random cosmic encounter of the little blue planet with destiny.

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