

Napoleon's Earthquake: The Seismicity of St. Helena

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INTRODUCTION

To many it might seem an exercise in futility to attempt a study on the seismicity of a small island in the middle of the Atlantic, far from the nearest monitoring station and not in an area of high seismicity. To some extent this may be true, but the fact that archival records can be found for the island going back 300 years and that these do mention some earthquakes makes this an interesting task with results worthy of record. This is particularly so as one of the earthquakes took place in the context of an important historical event: the exile of Napoleon Bonaparte to the island.

THE ISLAND OF ST. HELENA

Geography, History, and Geology

St. Helena is an island in the middle of the South Atlantic Ocean, located at 15.97°S, 5.72°W (see Figure 1). Nunn (1994) classifies it as an isolated intraplate island. It is approximately 800 km east of the Mid-Atlantic Ridge. The nearest other land is Ascension Island, 1,130 km to the northwest; the shortest distances to the nearest continental land masses are 1,930 km to Africa and 2,900 km to South America. The size of the island is about 121 km², with a maximum dimension of 17.4 km. St. Helena, with a population in 1991 of 5,632, is therefore one of the most isolated inhabited places in the world.

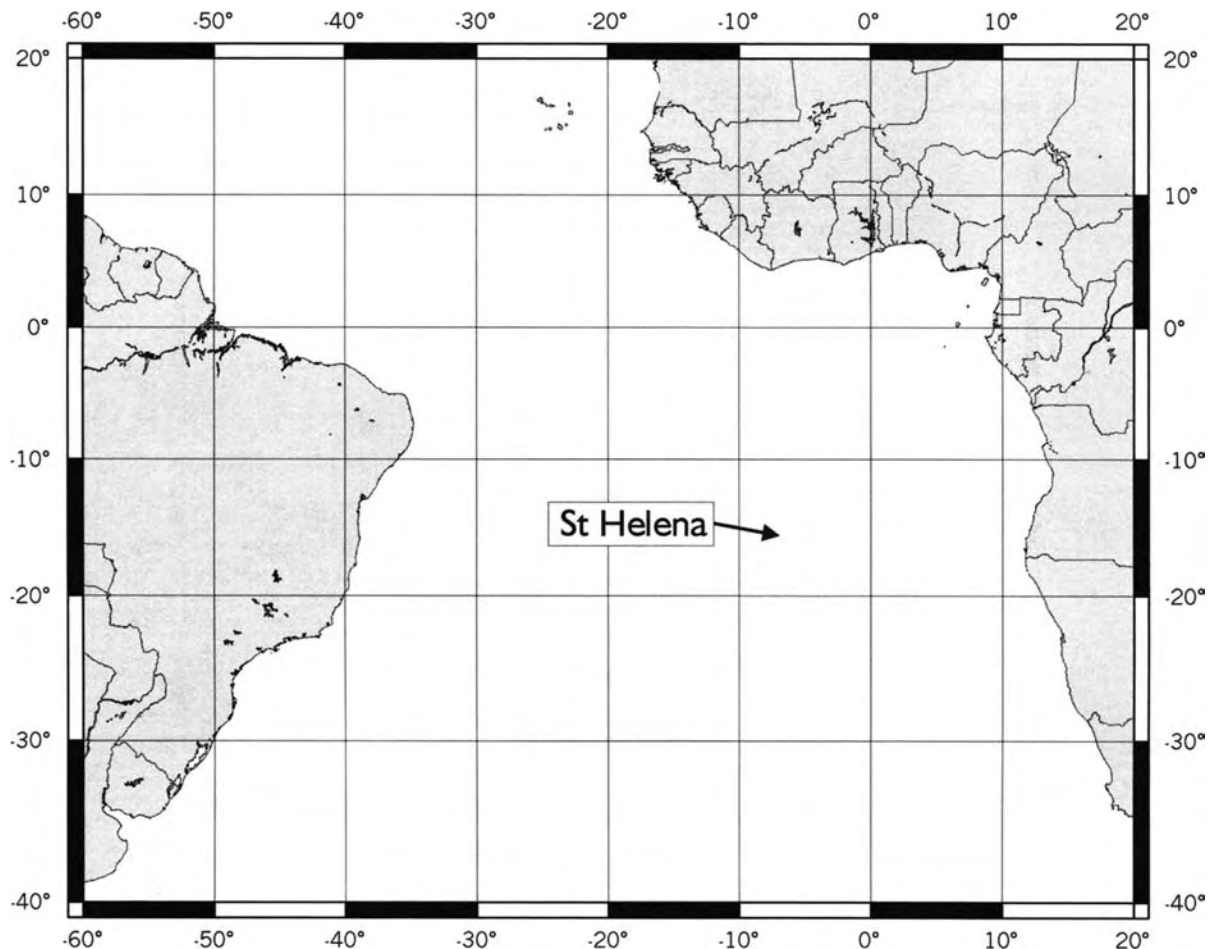
St. Helena is the deeply eroded remnant of an extinct northeast-southwest-trending volcanic complex rising from the oceanic floor at a depth of over 4,000 m to a present-day summit at Diana's Peak of 823 m above sea level. The base of this vast volcano has a maximum diameter of over 100 km, which, according to Daly (1927), gives it a base area of over ten times that of Etna and a volume of at least twenty times that of Etna. The undersea topography is described in detail by Holt (1995). The island has a radial drainage pattern with steep, deep valleys stepped in profile. The greater part of the coast consists of unscalable cliffs between these valleys, and the severe nature of the coastline contributed to St. Helena's role as an island fortress in historical times.

The island was discovered in 1502 by the Portuguese navigator João Da Nova. Although the island was frequently visited after its discovery by passing mariners as a useful source of fresh water and shelter for repairs, it was not permanently inhabited until 1659, when it was occupied by the English East India Company under a charter granted by Oliver Cromwell in 1657. The island was settled by company employees, English settlers, and some slaves. By the latter part of the century the island had become a routine landfall for ships en route to and from the East Indies. The island was captured by a Dutch force in 1673 during the Anglo-Dutch War but recaptured the same year. However, its main claim to fame is as the place of the final exile of the Emperor Napoleon I, from October 1815 until his death in 1821.

The first person to formally recognize the volcanic nature of St. Helena was Johann Forster, naturalist to James Cook's 1772–1775 Resolution expedition (Forster, 1982). Comments on the likely volcanism were made by Seale in 1834, but the definitive confirmation of the island's volcanic origin was made by Charles Darwin, who spent six days ashore on the homeward leg of the *Beagle* expedition (Darwin, 1839, 1876). A further geological study was made by Oliver (1869), but the first really comprehensive account of the geology of the island, including a consideration of its global tectonic relationships, was provided by Daly (1922, 1927).

Since then the most important work is that of Baker (1968a, 1968b, 1970), who provides a detailed chronology of the history of the volcanicity of the island based on K/Ar dating of a suite of 24 samples. This work showed that the age of the older shield is 14–11 m.y., the younger shield 11–8 m.y. The late intrusive phase is dated to 7.5 m.y. ago (Baker *et al.*, 1967; Baker, 1970). Since then, the only volcanic activity has been fumarolic in nature.

More recent studies of the Sr-Nb-Pd isotope characteristics of the St. Helena intrusives seem to indicate that the island is located on the track of a plume trail running northeast/southwest, marking successive stages in the migration of the African Plate, and therefore that it owes its origin to hot-spot activity in Miocene times (Coulon *et al.*, 1996). A useful summary of the geology is also given by Culshaw (1975),



▲ **Figure 1.** Location map showing position of St. Helena.

TABLE 1
Instrumental Seismicity around St. Helena

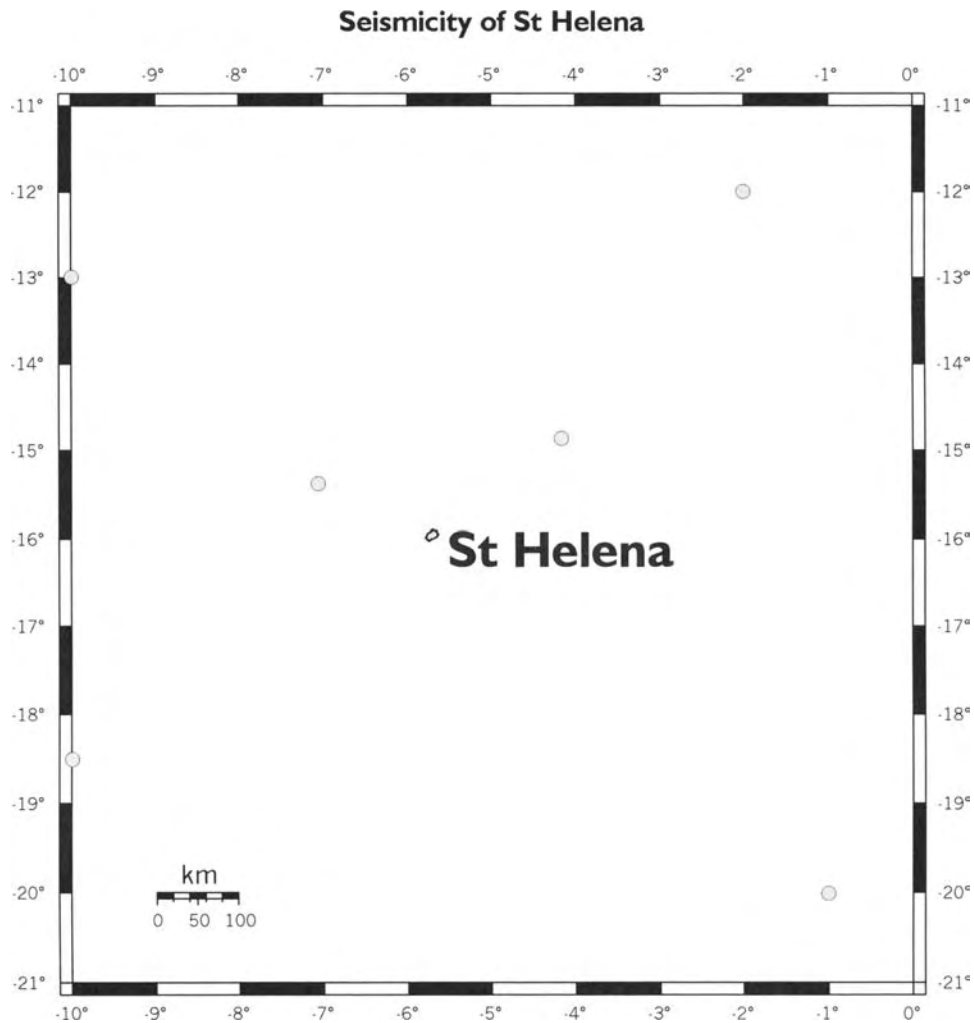
Date	Time (UTC)	Latitude (N)	Longitude (E)	Depth (km)	Magnitude
1917/8/2	21:38	-13.00°	-10.00°		
1920/6/26	07:30	-18.50°	-10.00°		
1923/12/12	16:27	-12.00°	-2.00°		
1925/8/25	12:56	-13.00°	-10.00°		
1927/3/30	07:17	-20.00°	-1.00°		
1984/12/1	09:37	-14.79°	-4.16°	10	5.1 m_b
1987/5/3	07:53	-15.34°	-7.05°	10	4.9 m_b

who has made a special study of the rockfall problem on St. Helena (Culshaw, 1975; Culshaw and Bell, 1992).

INSTRUMENTAL SEISMICITY

A search of the British Geological Survey World Seismicity Database (Henni *et al.*, 1998) was made for the area around the island (11°–21° S, 0°–10° W). Only seven events were found in this area (Table 1, Figure 2). Because of the extreme distance from the nearest seismic monitoring stations (and it

will be noted that the nearest continent, Africa, has been extremely poorly instrumented in the past), it is to be expected that the locations are not very accurate. Those from International Seismological Summary (ISS) data must be regarded as extremely approximate (and are noted as such in the original ISS bulletins). The two events from the 1980's reported by the International Seismological Centre (ISC) are closer to the island than the ISS epicenters (distances of 150–200 km, although these are still very uncertain), and it is possible that these events could have been felt, though no record



▲ **Figure 2.** Plot of the known instrumental seismicity within a 10° square around St. Helena.

of this has been found either from recollections of the inhabitants or reported in the *St. Helena News*, the island's weekly newspaper.

ISS does not report magnitudes, but since all the events between 1917 and 1927 were recorded up to about 90° away (the 1917 event was recorded up to 115° distance), it seems safe to say that the magnitudes must have been about 5 *m*_b; the 1987 event was recorded up to 86° away.

ISC also reported fifteen earthquakes in this area in the years 1967–1968. These are all spurious, being based solely on data from the experimental LASA program, and represent misinterpreted core phases from earthquakes on the Pacific rim (Ambraseys and Adams, 1986; Musson, 1990).

It is interesting to note the clustering in the data in Table 1; all the earthquakes come either from the ten-year period 1917–1927 or the three-year period 1984–1987. Given the uncertainties in the determinations, it would be conceivable that the earthquakes within each group were related and stemmed from common (or close) epicenters.

HISTORICAL SEISMICITY

Surprisingly, considering its remote location, the island's history has been well documented both with regard to manuscript sources (Smith, 1998) and published material (Reilly, 1978).

Searches of historical data sources reveal several earthquakes that have been felt on St. Helena, described here in chronological order.

7 June 1756

A record in the St. Helena government archives in Jamestown of a letter sent by the local East India Company Governing Council to their principals in London, dated 15 June 1756, states:

On the 7th instant a little before 7 o'clock in the morning were sensibly felt in several parts of the island two small shocks of an earthquake but did no manner of harm.

21 May 1763

A letter (again in the Jamestown archives) from one of the local directors of the East India Company to the company's principals in London describes "a violent shock of an earthquake" at 05:00. "The agitation was so strong in the South part of the Island as to shake the china off the shelves in the houses, but thank God no damage ensued" (Teale, 1981). The intensity of this shock would seem to have been 5 EMS (European Macroseismic Scale).

1770 (spurious)

An item in the *London Chronicle* (21 April 1770, page 1) states:

A morning paper mentions advice having been received of a dreadful earthquake at St Helena, which had entirely sunk the same in the sea; but this day at noon little credit was given to it.

Hoax earthquakes in the 18th-century newspaper press are by no means unknown and can stem from a number of reasons, including lack of genuine stories to make up space (Musson, 1986). The advantage of making up stories about some distant location (like St. Helena) is that the local readership would have no way of detecting the imposture, unless through the extent of the exaggeration, as would seem to have happened here.

1780

Nothing seems to have been recorded about this event except a mention by Melliss (1875) in a list of earthquakes he claims to have been aware of, including

... another in 1780 ...

In view of the lack of contemporary evidence, this event must be viewed as doubtful.

26 January 1782

The source of this event is another East India Company letter reprinted by Teale (1981).

A shock of an earthquake was felt throughout the Island attended by a rumbling noise which lasted about four seconds.

21 September 1817

A letter from Lady Emma Bingham, the wife of Sir George Bingham, then staying on the island, provides first-hand information on this event (Bingham, 1817).

On Sunday night, Sept. 21st at a quarter before ten Sir George, Major Harrison, Mr Trevennon and myself were sitting round the fire, conversing on various topics, when suddenly, as we at first imagined, a violent gust of wind arose, shaking the whole house

with a very rumbling noise like a waggon; the room and chairs where we were sitting, were violently agitated; we went as fast as possible to the front door, and found we were out in a fine moonlight night, with very little wind; we all exclaimed 'it must be an earthquake' and such it proved to have been; it lasted about 20 seconds and we have much to be thankful for, in this little spot under the circumstances of so much danger. In the Town it was felt very forcibly, and occasioned the Church bell to ring for sometime.

The "town" refers to Jamestown, the principal settlement of the island. Figure 3 (from Bellasis, 1815) is almost exactly contemporary with the earthquake and shows the style of building, including the church referred to. The Bingham residence was at Knollcombes, about 6 km south of Jamestown.

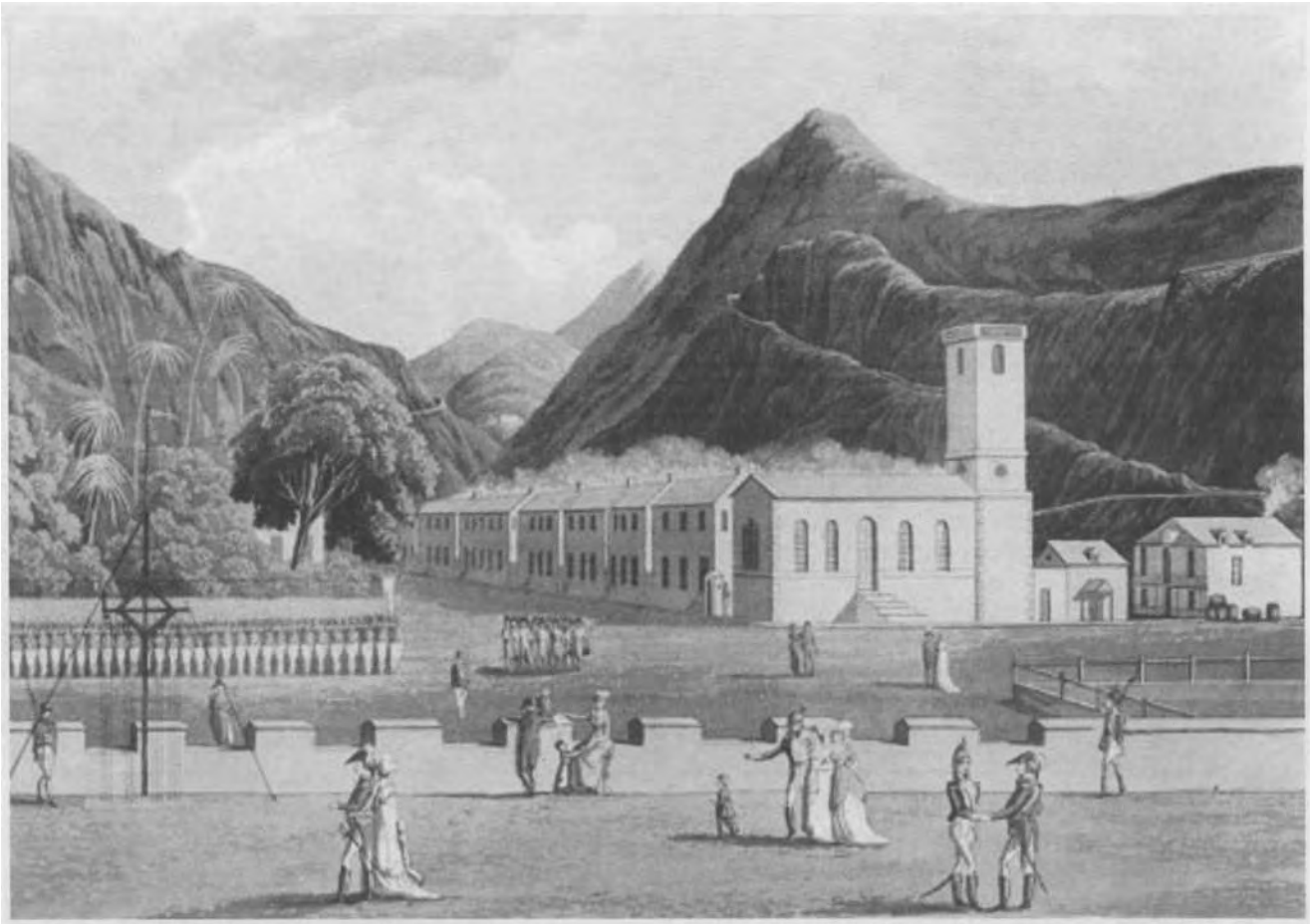
There is a second account extant, which, interestingly, describes the effects in the house where Napoleon resided (Longwood House). A letter written by Napoleon's personal surgeon (the Irishman O'Meara) to Sir Hudson Lowe (then the governor of the island), reprinted by Jackson (1903), states:

The whole of the house was shaken with a rumbling, clattering noise, as if some very heavy body, such as a loaded waggon, was dragged along the upper apartments, which was succeeded by an evident trembling motion of the ground; the glasses rattled on the table and the pictures receded from the walls. General Montholon stated that his son Tristan, who was asleep, was awakened by the shock, and explained that somebody was endeavouring to throw him out of bed. General Buonaparte informed me that on feeling the first shock he thought the Conqueror had taken fire or blown up, or that an explosion of powder had taken place on the island. He said he felt three distinct shocks and was of opinion that the duration of them might be about twelve or fourteen seconds.

General Montholon was one of Napoleon's officers who chose to accompany him into exile. The HMS *Conqueror* was a British ship-of-the-line stationed in St. Helena; the island was heavily garrisoned against any possible rescue attempts. Longwood is about 5 km northeast of Knollcombes and 5 km southwest of Jamestown.

The last account was recorded by Abell (1844) in her memoirs. At the time of the earthquake she was a twelve-year-old child named Betsy Balcombe, daughter of an East India Company employee. She enjoyed a very informal relationship with Napoleon, who treated her much as his own child.

... at the time we were on a visit to Madame Bertrand. ... the party was grouped about, some seated on the steps of the billiard room, others in the



▲ **Figure 3.** Original view of Jamestown in 1815, two years before the 1817 earthquake, showing the style of building and the church whose bell was rung by the shock. From Bellasis (1815).

garden. ... Suddenly we heard a heavy lumbering noise, as if loaded waggons were rumbling over the ground immediately under us. Those seated near the billiard room sprang up aghast, thinking the house was falling about their ears. Dr O'Meara and Major Blakeney who was appointed Captain of the guard at Longwood rushed immediately from their rooms expecting to find the ladies half dead with fear. All of the household, some of whom were in bed, ran out in the greatest alarm; some were gazing into the sky, others looking in wonder and amazement as to what had caused such a commotion. Little Tristram Montholon, who had some time previously retired to rest, came screaming to his mother, declaring that someone had been trying to throw him out of bed. The horror of this event occasioned by us all, can only be conceived by those who are acquainted with the island; more especially was the alarm felt by those whose friends and relatives were residing in any of the valleys, so narrow and wedge like in their form, and flanked, as they generally are by tremendous overhanging precipices, at the summit of which enormous loose rocks threatened continual

destruction to those who were beneath. It was observed at the time that had the shocks been lateral, instead of perpendicular, those who resided in the valleys must have been destroyed by the vast boulders of stone which would have fallen from the mountains above. Napoleon had retired to bed and it was not till the next morning that we saw him. He asked us if we had been frightened by the "tremblement de terre" on the previous evening, observing that I looked pale and quiet. He mentioned to General Bertrand that he at first thought the "Conqueror" a 74 lying in the harbour had blown up, and that the great powder magazine had exploded, but on feeling the third shock he perceived it to be an earthquake. It lasted from 16 to 18 seconds.

From these three accounts, an intensity of around 5 EMS is probable for this event. The last description is particularly interesting for its mention of the rockfall problem. It is clear from Abell's account that the earthquake did not trigger any rockfalls on the island. This may be partly due, as suggested at the time, to the shock being principally vertical (implying

a very local epicenter) but also indicates against any higher intensities being observed on the island.

12 August 1818

The source for this event is as for the 1763 and 1782 events (Teale, 1981); no time is given.

The shock of an earthquake throughout the Island for about half a minute. We are happy that no injury attended the event.

15 July 1864

This event is noted by both Melliss (1875) and Kitching (1947) without any details beyond the time, 04:10, and that “two pulsations” occurred within five seconds (Kitching 1947).

With effectively only one felt data point for each of these earthquakes, it is impossible to say where the epicenters were or how far offshore they were located. The balance of probability, though, is that these were relatively local earthquakes (and therefore small) rather than large, distant events. There are two reasons: (a) The volcanic structure of the island and associated seamounts is more likely to be seismically active than the surrounding ocean floor; (b) small earthquakes are much more probable than large earthquakes in such an area, and to be felt as strongly as the records suggest, they must have been fairly local. The comments about the vertical nature of the 1817 shock is further evidence in support of a local origin.

NAPOLEON'S EARTHQUAKE?

It is on record, as shown above, that Napoleon did feel the earthquake of 21 September 1817 at St. Helena and described his experience of it (and did not recognize it at first as having been an earthquake). This provokes the whimsical, but nonetheless intriguing, question of whether this was the only earthquake Napoleon ever felt? Most of his career was spent in places not very seismically active. Earthquakes are very seldom felt in Paris, and the areas where the bulk of Napoleon's campaigning was done (Germany, Eastern Europe) are also of low seismicity. The two exceptions are Italy and the Levant.

Napoleon's first Italian campaign lasted from 11 March 1796 (he leaves to become head of the Army of Italy) to 18 April 1797 (Peace of Leoben). Between these two dates, only two earthquakes occurred in the northern Italian area, the 20 April 1796 Buchs earthquake ($6.2 M_s$) and the 22 October 1796 Bassa Padana earthquake ($5.0 M_s$). The first of these events (Van Gils and Leydecker, 1991) occurred on the Swiss-Austrian border; Napoleon was near Mondovi, over 300 km away and too far away for the shock to be noticeable.

The second event occurred just before the Arcola campaign. Data on the felt effects of the earthquake are given by Monachesi and Stucchi (1998) and shown here as Figure 4.

The intensity was as high as 6 MCS (Mercalli-Cancani-Sieberg scale) around Vicenza, which was within the theater of operations of the Army of Italy. Napoleon's movements have been traced by Tulard (1992); the day of the earthquake was the day he arrived in Verona, where Augereau was stationed with 8,500 infantry and a cavalry brigade of 1,600. At Verona the intensity was 4–5 MCS, generally perceptible to those indoors, but the shock happened at 04:00, at which time Napoleon would have been still on the road from Ferrara and not likely to have felt this degree of intensity while traveling. So it seems that he just missed this earthquake.

Napoleon remained in Italy (in Milan) for most of the year 1797, but there were no earthquakes near Milan during that period.

Napoleon's Egyptian and Levantine campaign took place in 1798 and 1799. Considering the scientific entourage accompanying the French army, it is highly likely any earthquake occurring during the campaign would have been well documented. According to Ambraseys *et al.* (1994), no earthquakes occurred in this area during these two years.

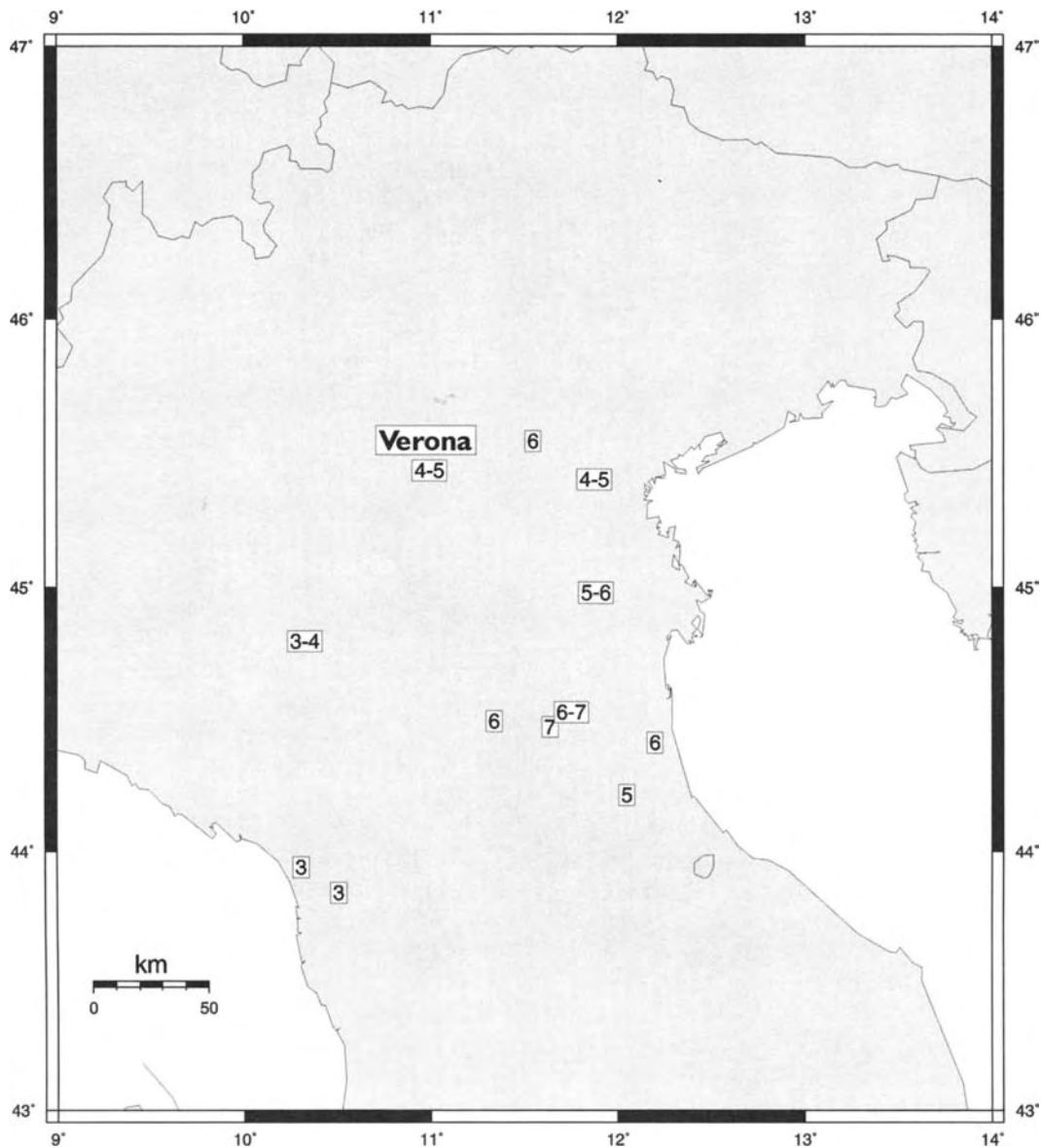
Napoleon's second Italian campaign took place in 1800, and there were no significant earthquakes in or around northern Italy at this time.

A check was made for the whole European area between 15 August 1769 (birth of Napoleon) and 15 July 1815 (Napoleon embarks on the *Bellerophon*) using the Basic European Earthquake Catalogue and Database (BEECD, 1998) working file. No other events likely to have intersected with Napoleon's career are known except for one: the earthquake of 6 October 1775 in Corsica itself, which occurred when Napoleon was six years of age and living in Ajaccio at the time. This earthquake is given a magnitude of $4.2 M_s$ by Monachesi and Stucchi (1998); they report only one felt observation, at Vico in Corsica, intensity 5–6 MCS. While it is surprising to have an observation from Vico and not from Ajaccio, one cannot rule out the possibility that the earthquake was felt in Ajaccio. This earthquake could therefore have been felt by the six-year-old Napoleon.

The answer to the question is, therefore, that while the earthquake of 21 September 1817 at St. Helena is the only earthquake of which we have a personal account from Napoleon, it is possible he might have felt one in his childhood. The fact that he at first mistook the 1817 event for an explosion and made no reference to recognizing it from previous experience does suggest that the Emperor did not have much in the way of previous earthquake recollections to draw upon.

CONCLUSIONS

We have presented as complete as possible an earthquake history for the small island of St. Helena and the surrounding area. In spite of the remoteness of this place, making the recording of the seismicity a seemingly impossible task, the excellent historical documentation associated with the British occupation of the island, reflecting its strategic importance before the opening of the Suez Canal, means that it is in fact



▲ **Figure 4.** Felt effects of the 22 October 1796 Bassa Padana earthquake, after Monachesi and Stucchi (1998). Napoleon's position would have been a short distance south or southeast of Verona.

possible to trace records of earthquakes extending as far back as the mid-18th century.

The seismicity of the island is low. The few events felt on it are most likely small local shocks associated with the island's volcanic origins and isostatic adjustments resulting from crustal unloading due to subaerial erosion (Watts, 1997). ☒

ACKNOWLEDGMENTS

The authors would like to thank Trevor Hearl of the *St. Helena Link*. Thanks to Martin Culshaw (BGS) for indicating useful sources on the history and geology of the island. Also thanks to Ian Baker for looking for felt reports of the two most recent earthquakes in the 1980's. Tom Holmberg and

George Lindley suggested some useful Napoleonic references. Paul Henni helped prepare the figures. This paper was supported by the Natural Environment Research Council (NERC) and is published with the permission of the Executive Director of the British Geological Survey (BGS).

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