

## Three little known early earthquakes in India

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The Bhuj earthquake of 26 January 2001 in Gujarat and a number of articles written after the event prompted this note. It looks at a number of earthquakes, which I found when I was reappraising the seismicity of the Middle East, some of them known but mislocated, and others little known or misinterpreted.

### 28 Dec 893 Daibul

Modern writers, particularly those writing after the Bhuj earthquake note a destructive earthquake in AD 893 on the Indus Delta. Tracing back the information about this event, I find that it is Hoff<sup>1</sup>, and after him Mallet<sup>2</sup> who first, on the authority of a 13th Century Syrian writer, Bar Hebraeus, say that a shock in 893 killed 180,000 people and destroyed a capital city in India, the name of which they do not give. Bar Hebraeus says that '...in 280 aH (anno Hijri) or 23 March 893 to March 894, there was a terrible earthquake and a great city in Outer India fell down, and 150,000 men were dragged from under the dust of the houses which had been thrown down, and were buried...'<sup>3</sup>.

Oldham takes up this information and places this earthquake in India, quoting as supporting evidence Ibn al Athir and later Arab writers who name the capital city as Dabil, but who do not say where the city was. Oldham realized that a place of this name could have been in Armenia but, without specifying its location, he places Daibul in India<sup>4</sup>.

Oldham is followed by later writers who place Daipul between Tatta and Karachi<sup>5</sup>, while modern writers even assign to Daibul a tentative intensity of VIII-X (MM)<sup>6</sup>, an early site on the Indus Delta, which has not yet been identified<sup>7,8</sup>. Various locations of Daipul have been proposed by Williams<sup>9</sup>, Cunningham<sup>10</sup> and Rajendran and Rajendran<sup>11</sup>, while early European navigation maps show also Daibhol or Dabil between Goa and Bombay, at 17.60°N–73.17°E, 870 km from Tatta<sup>12</sup>.

However, this information is not really pertinent in this note. What we are interested in here is not to locate the site(s) of

Daibul, but rather to identify the town which was destroyed by an earthquake in AD 893.

More information about this earthquake which I found in contemporary Armenian documents and marginal notes shows that it happened at Dvin or Dabil in Armenia, in the night of 15 Shawwal 280 aH (28 December 893)<sup>13–15</sup>. Full accounts of the earthquake are in al-Tabari and Ibn al-Jauzi, who accurately date the lunar eclipse on 27 December 893 that preceded the earthquake and describe the event in some detail<sup>16–18</sup>.

The area worst affected was that of the city of Dvin (40.02°N, 44.58°E) and its immediate surroundings, which had already suffered considerable damage in an earthquake 30 years before. All but about 100 houses in Dvin were destroyed, together with the metropolitan church and palace of the Catholicos, and 30,000 people were killed in the city. Damage extended over the plateau of Artashat where landslides added to the destruction, and Grigor, Bishop of R'tshunik and some of his followers who happened to be in retreat in the mountains, perished. This was a locally destructive earthquake affecting a rather small but densely populated region. Shocks recurred for five more days, adding to the damage.

It seems unlikely that Bar Hebraeus, the only writer who mentions India, could have read his source so uncertainly as to misplace the earthquake. On the other hand, he says that the event happened in 'Outer India', which may be taken to mean near the borders of India, or towards India, to the east from where he was writing. However, the source of his statement must remain, at present, obscure.

Although details of this event are quite clear, many and various errors of location have been associated with it. The main problem of modern writers has been to identify Dabil, which is the Arabic for Dvin and Dvin in Armenian<sup>19</sup>; errors that must be the result of lack of familiarity with the geography of the Middle East rather than a misunderstanding of the true place involved in Armenia.

Recently, after the Bhuj earthquake of 2001, age data of liquefaction features at

Vigakot (24.20°N–69.15°E), 130 km south-east of Tatta give calibrated ages of AD 875–1035, suggesting an earthquake during that period<sup>20,21</sup>, that may well have happened, but which could not have been the earthquake of 893 at Dabil in Armenia.

### 1664 Bangla

An earthquake, sometime between 1663 and 1664, caused considerable damage to settlements in Bangla.

The earthquake is noticed by Berryat, who dates it to 1664, and says that shocks which lasted for 32 days caused the bottom of a lake at a place, seven days journey (c. 140 km) from Dacca (25.0–90.0) to rise, as a result of which the lake dried up; he does not quote his source of information<sup>22</sup>. This information is repeated by Hoff<sup>1</sup>, Mallet<sup>2</sup>, Oldham<sup>4</sup> and Bapat *et al.*<sup>23</sup>, who place the earthquake at Dacca.

Original information about this event can be found in a letter from Ballasore, written on 6 January 1665/6 which says that. '...We have had several earthquakes unusual here, which, with hideous noise have in several places, swallowed up houses and towns; but about 7 days journey from Ducca, where were at that time three or four Dutch, they and the natives, relate this story. That in that place the earth trembled, about 32 days and nights without intermission; at the latter end, in the marketplace, the ground turned round as dust in a whirlwind, and so continued several days and nights, and swallowed up several men, who were spectators, who sunk and turned round with the earth, as in a quagmire; at last the earth worked up, and cast up a great fish, bigger than that has been seen in this country, which the people caught; but the conclusion of all was that the earth sunk with 300 houses, and all the men, where now appears a large lake, some fathoms deep. About a mile from this town was a great lake full of fish which in these 32 days of the earthquake, cast up all the fish on dry land, where might have been gathered many, which had run out of the water upon dry land

and there died; but when the other great lake appeared, this former dried up and is now firm land...<sup>24</sup>.

Another letter dated 11 February 1667/8 adds that '... There came lately to hand a letter from Ballasora, which you know lies near the Persian Gulf (*sic.*), relating, that there about had, not long since, been an extraordinary earthquake which lasted 32 days and nights, and swallowed up 300 houses and all ye men. And that, where the earth thus sunk with so many houses, there appeared in stead a large lake some fathoms deep. And then, yt at some distance firt yt place, another great lake full of fish, did in those 32 days of ye earthquake cast up all its fish on ye dry land, where might have been gathered many, and it, when the new great lake appeared the old one dried up, and became firm land...'<sup>25</sup>.

Most probably this is the earthquake mentioned in contemporary diaries which sometime before 1676, damaged Chittagong. It is also probable that this is the same event which was felt in the region of Guwahati, on the Brahmaputra river, 250 km north of Dacca, strongly enough to be noted in the local historical records. It happened in the evening of 11 Rajab 1073 aH (19 February 1663) and, allegedly continued for 30 min (Shihab al Din). The shock that was felt in Tibet on the evening of the second day of the lunar(?) month of the same year might have been from the same event<sup>26</sup>.

The effects of the earthquake described in these letters suggest liquefaction and spreading of the ground, probably the far-field effects of a large-magnitude event originating perhaps from the general area of the great earthquake of 12 June 1897 beneath the Shillong Plateau.

### 1668 May Indus Delta

Oldham, on the authority of Musta'id Khan, mentions an earthquake that occurred in May 1668 at Samaji on the Indus Delta. He says that at this time (between 1 and 10 Dhu'l-Hijja 1078 aH or, 2 to 11 May 1668) a report was received from the soobah (province) of Tattah that the town of Samawani (or Samanji), which belonged to the parganah (subdivision of a district comprising numerous villages) of Lahori, had sunk into the ground with 30,000 houses during an earthquake<sup>4</sup>.

Modern authors follow Oldham; Chandra<sup>27</sup> places the epicentre at Samaji,

which he locates vaguely north of Tatta and assigns to it an intensity X. Quittmeyer and Jacob<sup>6</sup> date the event to 3 May, and assign to it an intensity VIII-IX (MM). These authors do not give a location of Samanji; the former places it at 24.83°N–67.50°E, which is close to Tatta, and the latter dates the event to 2 May, places it at Samanji somewhere in Pakistan<sup>23</sup>. Gupta *et al.*<sup>28</sup> copy from Chandra<sup>27</sup>, and the US Geological Survey Earthquake Data Base, and Talwani and Gangopadhyay<sup>29</sup>, do not quote their source of information, assign to the earthquake a magnitude of 7.6.

Oldham's source, Musta'id Khan's text, written in 1710, gives a somewhat different account of the earthquake which says that '... It was reported from the province of Tatta, that the village of Samawani, in the jurisdiction of Bandar Lahori, had sunk down with 30,000 residents, owing to an earthquake...'<sup>30</sup>. The editor of Musta'id's Arabic text indicates an alternative spelling for the places mentioned as *Samanji* and *Lahiri*. The event is not dated, but the time it occurred may be reckoned from the fact that it is found between two other notices that refer to events dated to 15 April and 12 May 1668 respectively.

So far, attempts to retrieve additional information from contemporary sources in Elliot<sup>31</sup> and other sources proved fruitless.

In Musta'id' text Tatta, the capital of the synonymous province to which the earthquake was reported was, and still is situated on the Indus Delta.

Bandar Lahori (Lohrani of the Arabs, probably Loyari), the port of Tata, was situated near the former site of Duli Sindi, or Lahri Budar where the western branch of the Indus disembogued into the sea<sup>8,10,32,33</sup>.

Samawani, we are told, was a village in the jurisdiction of Lahori. Its actual position is unknown but it should have not been far from Lahori, which was peopled before Tatta, the remains of which were found about 7 km northwest of Tatta. Sumovee in January 1837 consisted of eight huts inhabited by those who looked after the nearby shrine of Shah Jindah.

Alternatively, Samanji may be Samanjo (the city of the Samaas), at the northern end of the Makli Hills where the shrine of Mulla Abdulla Luttur is at present.

There seems, however, nothing to lead one to assume that late in the 17th Cen-

ture, Samawani was an urban centre on the Indus Delta of such importance or size as to contain more than 30,000 inhabitants. If Samwani was on the Indus Delta, its size is grossly exaggerated, unless this number includes the population of the whole region affected by the earthquake.

Musta'id's account clearly implies that the earthquake did not damage Tatta and Lahori or, had these places been affected, damage should have been small, not worth reporting. Consequently, if Samawani was located on the Indus Delta, and Tatta and Lahori were not affected, the magnitude of the earthquake should have been relatively small. The 'sinking' of Samawani probably suggests liquefaction and slumping of the ground, not uncommon in this region that happens even without the help from earthquakes.

The assumption that the earthquake should have been small is supported by the observation that there is no evidence of damage in Ahmedabad, east of Tatta. The mosques of Masjid-Nagira and their minarets built in 1519, that which Sidi Saiyd built in 1573, the 21 m-high shaking minarets next to the Sidi Basjir mosque, and the Jumma Masjid built in 1424, stand intact. The exception are the two minarets of the Jumma Masjid, which were destroyed in the earthquake of 1957.

Attempts to retrieve additional information from contemporary sources, so far, proved fruitless<sup>31</sup>. The Indus Delta in the 17th Century was far removed from the coastal areas frequented by European traders, chiefly Portuguese and British. The nearest trading centres from which information could have survived in unpublished correspondence were in the Gulf of Cambay at Diu since 1517, at Surat since 1612, at Daman 1530, and further south at Bassein since 1534, more than 800 km from the Delta.

### Conclusions

I show that the 893 earthquake did not occur in the Indus Delta, that the 1664 earthquake probably was associated with the Shillong Plateau and that the earthquake of 1668 in the Indus Delta was a relatively small event.

Recent papers on the Bhuj earthquake refer to a large earthquake, which allegedly occurred in Tatta in 1668, not far from Bhuj<sup>28</sup>, to which the US Geological

Survey Earthquake Data Base assigns a magnitude of 7.6. The spurious 893 earthquake and the Bhuj and Allah Bund earthquakes of 2001 and 1819 have lead scientists to postulate an episodic tectonic evolution of the region with a return period of 170 years for large events.

The problem with historical seismicity is that recent years have seen a proliferation of earthquake catalogues with data from one catalogue being absorbed by the next. The single most common failing in this generation of regional and global catalogues has been that few of them are based on original sources of information and most rely on secondary evidence and a slavish repetition of previous lists, errors and all.

It may be that too much effort has been diverted from the retrieval and interpretation of original data from different languages to computer processing of second-hand information, to the extent that the tidying up of input data into a reliable and homogeneous body of information is essential.

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