

Review of "Tsunami heights and limits in 1945..." by Lodhi *et al.*

Review by E.A. Okal (I waive anonymity)

The paper attempts the compilation of a dataset of runup and inundation of the 1945 tsunami at three population centers along the coast of Pakistan, based on the interviews conducted earlier and compiled in the UNESCO report [Kakar *et al.*, 2015].

As such, the paper is a valuable extension of that work, which had reported the interviews in excruciating detail, but had fallen short of transforming them into a scientifically usable database. In this respect, the paper would deserve publication.

→ Unfortunately, it stops short of this goal because it does not provide coordinates (latitude; longitude) for the seven locales at which quantitative estimates are given in Table 1.

The paper cannot be published without this information, especially since "*The lat/long [sic, should use the word "coordinates"] of these landmarks were used to extract the inundation parameters using Google Earth*" [Page 3, Line 64].

Additional shortcomings of the paper are listed below.

Emphasize major conclusions

1. A major conclusion of this study seems to be that the number of fatalities was at most 150 (Table 2). This is in contrast to the figure of 4000 reported by the NOAA Tsunami Database. The discussion in the present paper would suggest populations of about 6000 in Gwadar (Line 72), 4000 in Pasni (Line 104, even though a newspaper reports 7000 people homeless) and perhaps 1000 in Ormora (Line 160), for a total of 11,000. The rest of the coast was probably very scarcely populated. A death toll of 4000 would amount to 1/3 of the total population, and would be an extremely high rate with long-lasting consequences on the economy of the province. It would probably have been mentioned repeatedly during the interviews of the (then very few) survivors. In this context, the NOAA figure is most probably grossly overestimated.

* Some discussion of this finding should be provided in the paper.

2. The newspaper clipping on Figure 3 contains an extremely important datum, namely that the tsunami reached Pasni around 07:00. The earthquake is known to have taken place at 21:57 GMT (on 27-NOV-1945), which agrees with the felt report at 03:30 (28-NOV) given IST (in use in 1945) = GMT + 5:30. There is therefore a delay of about three hours in the arrival of the tsunami. This is in line with the delay of ~2.5 hours reported by witnesses on the Iranian side [Okal *et al.* 2015], and also with the famous observation of the tsunami in the Seychelles [Beer and Stagg, 1946]. *This provides one more piece of evidence that the tsunami (or at least its main component) was generated by an ancillary phenomenon, most probably a landslide triggered by the earthquake, but with a significant time gap.*

Arguably, the report on Line 171 suggests a shorter time gap, but it has been our experience that the perception of time by witnesses often lacks precision. The fundamental point here is that the earthquake was felt in the middle of the night and the tsunami arrived by daylight.

→ At any rate, this point should be discussed in the paper.

Insufficient referencing

3. The authors fail to mention the quantitative compilation carried out across the border in Iran by *Okal et al.* [2015].
4. The authors mention *Atwater et al.* [2013] as a reference to tsunami surveys conducted for historical tsunamis many years after the event. However, this technique was pioneered a decade earlier for the 1946 Aleutian tsunami by *Okal et al.* [2002], which should probably be referenced.
5. The authors fail to reference the authoritative work of *Ambraseys and Melville* [1982] from which most of the information in *Dominey-Howes et al.* [2006] and *Pararas-Carayannis* [2006] is derived.
6. *Page 2, Line 54*
The reference to *Byrne and Davis* [1992] should not include first names (by the way, Dr. Byrne's is misspelt), and should really be *Byrne et al.* [1992] since the full authorship of that paper includes Professor L.R. Sykes, whose name has been reduced to his initials (L.R.S.) in the reference list.

Major problems: Tables; Figures

7. The coordinate scales on Figures 2, 5, 8 are completely out of range. Note that the longitude scales from 26°E through 176°E to 34°W. The latitudes are similarly extravagant.
* The captions for these figures should name the specific cities.
8. There are some obvious discrepancies in the ages quoted for the witnesses. Notwithstanding the difficulty of obtaining their ages (as discussed, *e.g.*, *Okal et al.* [2015]), the latter should be consistent.

Note for example the case of Ms. Amina on Table 1. She is quoted as being ≥ 100 yrs. old at the time of the interview

(Note that 100+ is not a proper scientific notation. Use the symbols $>$, \geq , etc.)

but only 20 in 1945. She would then have been born in 1925, which would make her at most 90 in 2015 or 95 in 2020.

Similarly, Ajyani Guli cannot have been 11 in 1945 (b. 1934) and already ≥ 90 at the time of the interview.

Other issues

9. All information should be metric. Convert feet to meters throughout.
10. *Page 2, Line 32*
The authors should emphasize the difference between the 2013 event for which a definitive tsunami requiring a landslide was observed, and the landslide on the Owen Ridge [*Rodriguez et al.*, 2013] which is well documented, but for which the tsunami attacking

Oman can only be inferred.

11. *Page 2, Line 57*

The earthquake was followed by five **recorded** aftershocks. There probably were many more.

12. *Section 3.1*

There are references to Table 0.1) and Fig 0.2. This needs to be corrected.

13. *Figure 1*

Part (a) of the figure is hardly legible. I had to use a magnifying glass to decipher it.

Translate the material in Arabic (or is it another language?) in Part (c), which will otherwise be completely useless to most of the readership.

14. *Page 14, Table 2, Last Column*

The figure 13,33,000 makes no sense (even though it seems to be quoted directly from the Baluchistan Agency Administration Report on Figure 3). Does this mean 1,333,000 or 13,330,000 ? At any rate, if a proper rendition of this number is given, then an exchange rate to a more universal currency should be included (*e.g.*, Rp. XXXXX, equivalent to present-day YYYYYY £ or US \$ ZZZZ or TTTT €).

15. The English of the paper should be improved throughout. There are articles, occasionally verbs, missing. Dr. Brian Atwater's name is misspelt in the Acknowledgments, etc.

Additional references cited

- Ambraseys, N.N., and C.P. Melville, *A history of Persian earthquakes*, Cambridge Univ. Press, 219 p., 1982
- Beer, A., and J.M. Stagg, Seismic sea-wave of November 27, 1945, *Nature*, **158**, 63, 1946.
- Okal, E.A., C.E. Synolakis, G.J. Fryer, P. Heinrich, J.C. Borrero, C. Ruscher, D. Arcas, G. Guille, and D. Rousseau, A field survey of the 1946 Aleutian tsunami in the far field, *Seismol. Res. Letts.*, **73**, 490–503, 2002.
- Okal, E.A., H.M. Fritz, M.A. Hamzeh, and J. Ghasemzadeh, Field survey of the 1945 Makran and 2004 Indian Ocean tsunamis in Baluchistan, Iran, *Pure Appl. Geophys.*, **172**, 3343–3356, 2015.