

Interactive comment on “A calibrated radiocarbon database of late Quaternary volcanic eruptions” by R. U. Bryson et al.

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General Comments.

One of the major unresolved issues in the understanding of the relationship between volcanism and climate is the question of what is the driver: does enhanced volcanism force climate changes at critical points in time; or do the consequences of changing climate (changing sea levels, ice loads) modulate volcanic activity?

This issue has been explored at length over the past thirty years, with studies on local, regional and global scales using a varied array of proxies for both volcanism and climate. Bryson, Bryson and Ruter return to this question with the development of a database of radiocarbon-dated eruptions (of global extent). This extends and develops

an earlier database by the same authors; the new database contains over 2000 entries, all of which are calibrated (using CalPal) and which range in age from ca. 100 radiocarbon yrs BP to 40,000 radiocarbon yrs BP. The authors clearly intend this database to be used (e.g. as a source term in climate modeling; or to investigate more closely relationships between volcanic eruptions and climate records), and to that end show how a simple ‘de-trended’ index of past eruption rates may be derived from the dataset.

Specific Comments.

While the development of a database of dated volcanic eruptions is a noble effort, rapid inspection of the dataset suggests that one should only use it (if at all) with a great deal of caution. The authors claim that they have ‘worked to keep the database current’ (section 1, line 21); and that they have ‘culled all duplicate dates so that single eruptions are not recorded more than once’ (section 2, line 20). Taking as a single example Santorini volcano, Greece, however, it is not clear that either statement is correct: the most recent radiocarbon age determination cited in the list was published in 1984; and up to four of the age determinations in the database most likely correspond to the same eruption (the ca. 21 kyr BP Akrotiri Ignimbrite or Cape Riva eruption). Indeed, the lack of cited papers from the past decade in the references accompanying the database does not give much confidence in the completeness of the database - simply in terms of published material that is in the public domain (leave alone the completeness in terms of the geological record). A quick scan of the *Journal of Volcanology and Geothermal Research* (for example) reveals tens of papers that present new radiocarbon determinations on volcanic contexts around the world from the past 10 years.

In other respects, the database is also potentially misleading: there is no attempt to distinguish systematically between the dated events in terms of eruption scale (which dated events were small, large, explosive or effusive?); few of the dated events are identified with stratigraphically defined eruptive deposits; ages include dates of both short-lived and long-lived materials; and there are dates of units sealed by eruptions

(e.g. paleosols, and peats), and of units overlying volcanic deposits. Thus, while it might be very tempting to fit a simple serpentine curve through the raw data and to interpret deviations from this curve as having some significance, it is far from clear that this approach can (yet) be justified. Perhaps a less ambitious approach might be to start with a geographically restricted region, and to mine the complete record of such an area, before attempting to develop a global database. Even with this approach there are serious questions over how one assesses the quality and completeness of the dated record (see for example, Glazner et al., on eruptions in eastern California; or Nowell et al., 2006 on the record of Quaternary eruptions in France and Germany).

Overall, the publication of this fragmentary database would be a small step forward in a potentially very important endeavour. With much more work, and considerable augmentation, we might eventually reach the point of having a robust if partial record of late Pleistocene to Holocene volcanic activity. At the present point in time, however, the database needs a substantial health warning: it is far from complete and cannot be interpreted as an index of Quaternary volcanism.

Glazner, AF et al., 1999, Fire or ice: Anticorrelation of volcanism and glaciation in California over the past 800,000 years, *Geophysical Research Letters* 26 (12): 1759-1762

Nowell, DAG et al., 2006, Episodic Quaternary volcanism in France and Germany, *Journal of Quaternary Science* 21 (6), DOI: 10.1002/jqs.1005.

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