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Discussion

Historical volcanoes of Armenia and adjacent areas: What is revisited?

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Abstract

The validity of some data in Karakhanian et al. [Karakhanian, A., Djrbashian, R., Trifonov V., Philip H., Arakelian S., Avagian, A., 2002. Holocene–historical volcanism and active faults as natural risk factor for Armenia and adjacent countries. Journal of Volcanology and Geothermal Research, 113, 1, 319–344; Karakhanian, A., Jrbashyan, R., Trifonov, V., Philip, H., Arakelian, S., Avagyan, A., Baghdassaryan, H., Davtian, V., Ghoukassyan, Yu., 2003. Volcanic hazards in the region of the Armenian nuclear power plant. Journal of Volcanology and Geothermal Research, 126/1–2, 31–62] that are revisited by R. Haroutiunian is considered. A conclusion is made that the revisions suggested by Haroutiunian concern unessential parts of the content of work by Karakhanian et al. [Karakhanian, A., Djrbashian, R., Trifonov V., Philip H., Arakelian S., Avagian, A., 2002. Holocene–historical volcanism and active faults as natural risk factor for Armenia and adjacent countries. Journal of Volcanology and Geothermal Research, 113, 1, 319–344; Karakhanian, A., Jrbashyan, R., Trifonov, V., Philip, H., Arakelian, S., Avagyan, A., Baghdassaryan, H., Davtian, V., Ghoukassyan, Yu., 2003. Volcanic hazards in the region of the Armenian nuclear power plant. Journal of Volcanology and Geothermal Research, 126/1–2, 31–62]. This article presents new evidence and re-proves the earlier conclusions that are disputed or revised by R. Haroutiunian.

Keywords: Armenia; volcanic eruption; earthquake; historical evidence

1. Introduction

R. Haroutiunian's publication on *Historical Volcanoes in Armenia and Adjacent Areas Revisited* is the third one the author has published on this topic recently. The two preceding publications (Haroutiunian, 2004, 2005) and the article published in this volume of JVGR are focused on the criticism and revisiting of the data presented in our publication of 2002 (Karakhanian et al., 2002). In many aspects, these publications of R. Haroutiunian repeat one another.

With time, any publication becomes out of date and must be revisited. The article of Karakhanian et al. (2002) in JVGR was prepared in 1999 and it is natural

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that since then new evidence has been accumulated both by the authors, and by other researchers. In 2004, Karakhanyan et al. published an article in an Armenian scientific journal (Karakhanian et al., 2004) trying to summarize new evidence related to some of active volcanoes in Armenia, in response to the criticism of R. Haroutiunian and re-prove the earlier suggestions published by Karakhanian et al. (2003, 2004). However, the Armenian publication of Karakhanian et al. (2004) is not easily accessible for the audience of JVGR. Therefore, the authors have decided to take the opportunity kindly provided by JVGR editors and to use the forum of this international journal to express their view and validate again some of their statements disputed and/or revisited by R. Haroutiunian.

1.1. About a subaqueous eruption in Lake Van in 1650

Certainly, the description Milton (1985) gives of the effects observed on 27.10.1650 is well consistent with one of a volcanic eruption, so Haroutiunian presented a really striking example of historical evidence about volcanic eruption in Lake Van.

Obviously, the record about the phenomenon observed on 13.04.1692 and quoted in Karakhanian et al. (2002) has many fewer details that can be interpreted as volcanic effects. Nevertheless, a volcanic phenomenon still could be suggested, and we do not think that a sandstorm mentioned by Haroutiunian is a more plausible, or the only possible interpretation. Haroutiunian published his finding of Milton's data in 2001 (Haroutiunian, 2001), after the paper by Karakhanian et al. (2002) was submitted to JVGR. This could explain the skepticism we expressed with respect to the date of 27.10.1650 first mentioned in our publication of 1997. During the preparation of the manuscript for the publication of Karakhanian et al. (1997), with the kind suggestion of Haroutiunian (and with reference to his personal communication), we included a brief mention of volcanic events in the Lake Van region recorded by historical chronicles in 1111 and 1650. However, Haroutiunian had not then communicated any additional data in support of the reality of a volcanic eruption in 1650 in the Lake Van Region. Now, we have revised our previously skeptical opinion.

1.2. On the eruption of volcanoes of the Porak Group

Studying the Pambak-Sevan-Synik Fault (PSSF) in 1998, we noticed that volcanoes of the Porak Group were located directly in the zone of this fault that is the most active one in Armenia. In 1990–1999, we conducted several field investigations within this segment of the PSSF, including active fault mapping, and studies of paleoseismicity, archaeo-seismicity, and volcanism. Geologists from Armenia, France and Russia took part in the studies (Trifonov et al., 1994; Philip and Karakhanian, 1999; Philip et al., 2001). Our publication of 2002 in JVGR was also based on the results of the 1990–1999 surveys.

After 2001, our geological and archeological studies in the Porak Volcano region have been extended considerably and involved a larger number of participants, among them the NAS Institute of Geological Sciences (Armenia), GEORISK Scientific Research CJS (Armenia), NAS Institute of Archaeology and Ethnography (Armenia), Institute CORBY, Maison de l'Orient (Lyon 2 University, France), Montpellier-2 University (France), and the Geology Institute of the Russian Academy of Sciences (Russia). In part, new evidence from these studies is presented in Trifonov and Karakhanyan (2004) and Karakhanian et al. (2004). The latest research results are now prepared for publication.

Below, we will try to re-justify our statements revisited by Haroutiunian. The first and most substantial of the suggested revisions is that the eruption of Porak in the 8th century B.C. was not actually accompanied by a strong earthquake. Then Haroutiunian states that eruption happened not only in 782–773 B.C., as indicated in Karakhanian et al. (2002), but also 40 years later, in 742–739 B.C.

Porak Volcano is located in a clearly identifiable structure of a pull-apart basin, formed by the active PSSF. The data of GPS measurements show that rates of right-lateral strike–slip motions along the PSSF at this site correspond to 2–2.9 mm/year, and extension rates are within 2.5–3.5 mm/year (Karakhanyan et al., 2004; Davtyan et al., in press).

At the fault segment located near Porak Volcano, we identified clear scarps of surface ruptures generated by strong earthquakes and cutting through Holocene lava flows. The paleoseismological trenching (12 trenches in total) provided us 26 samples studied by the radiocarbon and archeological methods for dating. This allowed us to construe the age of the three strong seismic events that had produced the surface ruptures and scarps at the site. The first event happened about 19,790 years BP, the second was between 5208 and 4487 B.C., and the third one, as attested by ^{14}C analysis, occurred between 1000 and 500 B.C. (Philip et al., 2001; Karakhanian et al., 2002, 2004).

The archaeological studies in the region of Porak Volcano enabled the discovery of a few ancient