# HYPOTHETICAL SOURCE CRATER FOR AUSTRALASIAN TEKTITES: MOVING FROM INDOCHINA TO NORTHWEST CHINA?

J. Mizera[1], Z. Řanda[1], J. Kameník[1], J. Klokočník[2], and J. Kostelecký[3], [1]Nuclear Physics Institute, The Czech Academy of Sciences, Řež, Czech Republic, E-mail: mizera@ujf.cas.cz, [2]Astronomical Institute, The Czech Academy of Sciences, Ondřejov, Czech Republic, [3]Research Institute of Geodesy, Topography and Cartography, Zdiby, Czech Republic.

**Introduction:** A source crater for Australasian tektites (AAT), the largest tektite group in terms of the quantity recovered and the strewn field area, has not been found so far. We have argued against the generally accepted hypothetical location of the crater in Southeast Asia (Indochina) and present an alternate hypothesis of a possible location of the AAT source crater in deserts of Northwest China [1]. This hypothesis is based mainly on striking geochemical similarities between AAT and Chinese loess (CL) or its precursors, including Sr and Nd isotopes, contents of the cosmogenic radionuclide $^{10}$Be, and Li and B isotopes. Other supporting evidence is provided by the unique geological setting of the suggested target area. The current work justifies the hypothesis introduced in [1], and supplements it with new supporting evidence based on global gravity data.

**Discussion of results:** Twenty AAT samples of various morphological types (splash-form, ablated splash-form, layered - Muong Nong) from various sites in Southeast Asia, South China and Australia were geochemically characterized by instrumental neutron and photon activation analyses. Geochemical compositions of AAT were virtually identical to those published for CL except for several elements probably volatilized during the impact and tektite formation processes. Reported variations in the Sr and Nd isotope systematics and $^{10}$Be contents in AAT correspond well to those in CL, and even better to those found in CL precursors - aeolian sands in deserts of Northwest China. Isotopic variations in AAT are probably due to variable proportions of silicates and carbonates in the source materials, and may reflect the stratigraphic history of the target area as a result of local and global climatic changes and aeolian processes. The geochemical and isotopic composition of AAT, which lacks signs of chemical weathering under warm and humid conditions, is probably the strongest argument against localizing the AAT source crater to Indochina. It is not compatible with prevailing sedimentary targets in Indochina, where the presence of suitable loess-like materials at the time of impact has not been documented. Suggested offshore crater locations may also be ruled out by geochemical and isotopic compositions of AAT lacking signs of a marine environment. A possible location of the crater directly inside the main part of the strewn field, based on the distribution of layered AAT, lacks analogy with other tektites and their strewn fields, where tektites are always distant from known source craters. The fact that such a large impact structure has not been discovered in a thoroughly explored and exploited area also makes this location quite improbable.

We have proposed a new hypothetical location of the AAT in the large deserts of Northwest China, preferably in the Badain Jaran or Tengger deserts on the Alxa Plateau [1]. This location meets the conditions of sufficient supply of suitable source materials and burial of the crater. The megadunes in the Badain Jaran desert, up to hundreds of meters tall, would provide a perfect hiding place for a crater, while the unique geological features of the area, including formation and maintenance of the megadunes and lakes [2-5], could be partially attributed to post-impact effects. Inspection of global gravity data in the target area, using selected functionals of the disturbing potential (mainly the gravity anomaly and second radial derivative $T_{zz}$ [6-7]), computed by the latest combined global gravity field model EIGEN-6C4 [8], has shown the existence of a circular geopotential structure, centered at 39.7°N, 102.2°E and covering roughly the lake area in the Badain Jaran desert. The structure is characterized by a negative gravity anomaly of about -100 mGal with a diameter of <50 km, surrounded by a fragmented rim with a pronounced positive gravity anomaly, of diameter >100 km.

**Conclusions:** Moving the currently accepted hypothetical location of the AAT source crater ~2000 km to the north, from Indochina to deserts of Northwest China, would not change dramatically most current model considerations and interpretations, such as distribution of various morphological and constitutional AAT types, microtektites and unmelted ejecta. The new location better meets conditions of sufficient supply of compositionally suitable source material and filling and burial of the crater. We would like to provoke intensive investigations in the proposed target area, including a search for shock metamorphic features, which would confirm or disprove this hypothesis.

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