Paleomagnetic study of a new tektite field in South America

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Résumé

Under certain conditions, when an impact occurs on Earth, the impacted rocks melt and are expelled outside the crater. These melt ejectas are found under the form of glass objects called tektites. The earth's surface over which tektites of a similar age and presumed origin are found is named strewn field.

The way tektites are formed make them interesting objects to conduct a paleomagnetic study, and may provide constraints on impact mechanisms. Tektites may contain nickel and iron due to meteoritic contamination (Senftle et al. 1964). Such feature can be easily detected and quantified looking at their magnetic properties (Senftle et al., 2000). A weak remanent magnetization has been measured in some tektites and was interpreted as a thermoremanence (De Gasparis et al., 1975). Tektites are likely able to record the Earth's magnetic field when cooling during their flight. Transient impact-generated fields have also been evoked as a potential magnetizing field but have never been evidenced in natural impact settings (Carporzen et al., 2012; Weiss et al., 2010).

In this study we perform a paleomagnetic study on a set of impact-related glasses (_˜tektites) from a newly discovered strewn field in Chile (Devouard et al., 2014). We measured the natural remanent magnetization (NRM) and performed stepwise demagnetization to try and understand how these objects get magnetized.

If the above-mentioned NRM study confirms that tektites indeed carry a reliable record of the Earth's magnetic field, we would test a novel concept: estimating the location of the impact crater. For this purpose we will define the angle between this magnetization and the flight direction given by the aerodynamic shape of the elongated ones. This technique could be also applied to tektites from another strewn field (e.g., Australasites, whose source crater is unknown and for which we have extensive collection in museums).

We studied 22 tektites (17 with elongated shape and 5 with a disk shape), with a mean mass of 1 gram. These tektites were collected from 10 different sites scattered over 150 sq. km. The average susceptibility is 216 ± 145 10-9 m3.kg-1. This value can be compared to the mean range defined in the literature for others tektite strewn fields: 20-100 nm3.kg-1

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*Intervenant

(see Rochette et al. this conference). NRM intensity varies between 7.15 10-8 Am^2.kg-1 and 1.21 10-4 Am^2.kg-1. sIRM is in the range 44-3000 10-6 Am^2.kg-1. ARM were acquired in a DC field of 0.2 mT giving intensities comprised between 1.49 and 137 10-6 Am^2.kg-1.

NRM demagnetizations were done using AF and thermal methods respectively on 19 and 3 tektites. Preliminary data analysis shows that half of the studied tektites exhibit at least one stable component of magnetization.

Tektites with the highest NRM intensities (above 1.8 10-6 Am^2 kg-1) and susceptibility above 180 nm3.kg-1 seem to provide the best paleomagnetic results. These characteristics will be used as a selection criterion for futher investigations.

We will discuss the results in terms of the magnetization process, magnetizing field, the effect of the tektite shape on the NRM, the effects of the impactor contamination on the NRM, and the possible links between the angle between the NRM and the tektite flight axis.

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