A novel application of (U-Th)/He geochronology to constrain the age of small, young meteorite impact craters: A case study of Monturaqui crater, Chile

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Small and young impact structures have been commonly dated by methods such as thermoluminescence, ^{14}C, short-lived extinct radionucleide and cosmogenic techniques. However, (U-Th)/He dating is a low temperature radiometric technique that could potentially bridge the gap between the previously mentioned methods and common geochronological techniques employed on larger impact structures to yield precise impact formation ages. Here we report (U-Th)/He apatite and zircon single crystal ages from the small and young Monturaqui impact structure. The very small size of this crater will act as an ultimate test for the applicability of the low temperature (U-Th)/He technique for dating very small, young impact structures.

We selected two samples of impactite from the Monturaqui crater, representing different lateral sampling areas from the ejected material. A total of 10 zircons and 22 apatite grains were analyzed, and yielded a total of 10 successful zircon ages, and 12 successful apatite ages. The zircon (U-Th)/He ages range from 0.662 to 197.3 Ma and the apatite (U-Th)/He ages range from 0.616 to 61.5 Ma. This age fits well with the previous age range estimates for Monturaqui, and the range is interpreted to reflect a set of partially to completely reset (U-Th)/He ages, which yielded 2 reset apatite ages and 1 reset zircon age, which give a mean age of 663 ± 90 ka.

The results of this study show that the (U-Th)/He dating method has the potential to yield accurate ages for even very small impact structures, like Monturaqui: 663 ± 90 ka. Many of the grains are only partially reset, requiring analysis of a large number of grains to obtain an accurate age, similar to detrital dating studies.

Calorimetry in soil sciences: An unique approach

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All physical, chemical and biological processes are accompanied by changes in energy which means, heat. This makes calorimetry one of the most suitable techniques to study all these process [1]. In Soil study, microorganism, microbial biomass and organic matter are the most important parameter of soil quality [2] and they could be evaluated, at the same time, using Calorimetry, more generally by ITC and DSC.

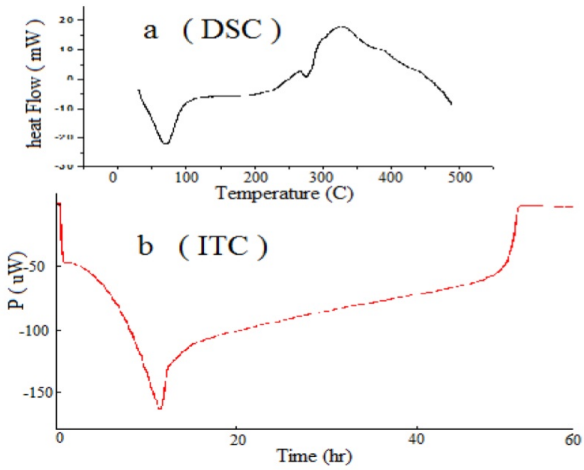

Figure 1: DSC (a) and ITC (b) curves of soil sample

In this study we have evaluated the use of Isothermal microcalorimetry (ITC) to study the effects of soil aging and influence of different experimental conditions on the glucose degradation of Brazilian soil. We also study the influence of the green house effect on the soil metabolism using ITC (Fig.1b). Differential Scanning Calorimetry used to study various properties (organic matter etc) of the soil understudy (Fig.1a). [1] Barros, N.; Salgado, J. and Feijóo, S, (2007) Thermochimica Acta **58**, 11. [2] Sposito, G (1989), The Chemistry of Soils., Oxford University Press, New York, pp, 43