THE PARENT BODY OF THE CA. 480 KYR-OLD TUNGUSKA-LIKE IMPACT OVER ANTARCTICA

M. van Ginneken[1], C. Suavet[2,3], C. Cordier[1], L. Folco[1], P. Rochette[3] and C. Sonzogni[3]. [1]Museo Nazionale dell'Antartide, Università di Siena, Italy. E-mail: vanginneken@unisi.it. [2]Massachusetts Institute of Technology, USA. [3]CEREGE, Université Aix-Marseille III, France.

Introduction: Meteoritic ablation spheres (MAS) recently found on top of the Victoria Land Transantarctic Mountains (TAM) and in the EPICA Dome-C and Dome-Fuji ice core document the impact of a 10^8 kg (or larger) cosmic body in the Antarctic region ca. 480 kyr ago [1,2,3]. The exact nature of the impactor is unknown, and whether the impactor struck the Antarctic ice sheet or exploded in the atmosphere is matter of debate. In order to address these questions, we discuss high-precision oxygen isotope compositions of two aggregates of MAS from the TAM.

Methods: Two MAS aggregates, namely #20c.25 and #20c.351, from micrometeorite trap #20c, Miller Butte, Antarctica, were selected with a Scanning Electron Microscope (SEM) for oxygen isotope analysis. Two samples of host granite detritus, of which one was cleaned of weathering products, were also selected to study the effect of weathering and bedrock contamination. Oxygen isotope compositions were determined using the IR-laser fluorination coupled with mass spectrometry (IRMS) technique adapted for the study of extraterrestrial materials following [4].

Results: SEM observations show a larger amount of weathering products in #20c.351 compared to #20c.25. Oxygen isotope compositions are $\delta^{18}O = 2.98$ and $\Delta^{17}O = -3.26$ for #20c.25, $\delta^{18}O = 6.50$ and $\Delta^{17}O = -0.54$ for #20c.351, $\delta^{18}O = 13.65$ and $\Delta^{17}O = 0.03$ for cleaned host granite, and $\delta^{18}O = 4.97$ and $\Delta^{17}O = 0.09$ for host granite with weathering products (analytical uncertainties are ±0.27‰ for $\delta^{18}O$ and ±0.07‰ for $\Delta^{17}O$).

Discussion: Comparison of oxygen isotope compositions of MAS aggregates and host granites indicate that alteration broadly shifts the MAS aggregate composition toward those of host granite, with maximum alteration on the Terrestrial fractionation line. Pristine bulk composition of the MAS, derived from modal composition of sample #20c.25 [1], is $\Delta^{17}O \approx -3.86$‰, thus similar to those of CV, CO and CK chondrites and of anhydrous silicates in short period comet 81P/Wild 2. Mixing models indicate that during the formation of MAS, interaction with oxygen from the Antarctic ice was likely minor, therefore ruling out direct impact on the ice sheet and favouring a Tunguska-like airburst in the low-atmosphere. This conclusion is consistent with the continental distribution of the paired MAS [1].

Conclusion: MAS from the TAM and the EPICA Dome-C and Dome-Fuji ice cores resulted from a Tunguska-like airburst over Antarctica ca. 480 kyr ago, implying an object several tens of meters in size or larger, either an asteroid of CV, CO or CK composition or a short-period comet similar to 81P/Wild 2 .

References: [1] van Ginneken et al. 2010. *Earth and Planetary Science Letters 293*:104–113. [2] Narcisi et al. 2007. *Geophysical Research Letters* 34:L15502. [3] Misawa et al. 2010. *Earth and Planetary Science Letters* 289:287–297. [4] Suavet et al. 2010. *Earth and Planetary Science Letters* 293:313–320.

Acknowledgements: This work was supported by the PNRA and by the EU-funded ORIGINS project.