PETROGRAPHY AND U-Pb CHRONOLOGY OF ANOMALOUS EUCRITE SERRA PELADA.

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Introduction: Serra Pelada is a brecciated eucrite observed to fall in the State of Pará, northern Brazil on June 29th 2017. There are very few published studies on this new meteorite [1]. The latest petrography studies have described this meteorite as a monomict eucritic breccia, which samples a single basaltic lithology [1]. Here we report the petrography and zircon U-Pb dating results for this new meteorite.

Experiment: Two polished thin sections were examined using a Carl Zeiss SUPRA-55 field-emission scanning electron microscope equipped with energy dispersive spectrometer (EDS) at the National Astronomical Observatories (NAO), Chinese Academy of Sciences (CAS) in Beijing. Cr and O isotope data were obtained at UC Davis and UNM respectively. In-situ U-Pb isotopic analysis for zircon grains was performed on a Cameca IMS-1280 ion microprobe at the Institute of Geology and Geophysics, CAS. Due to the small size of zircon grains in Serra Pelada, the analytical spot size was reduced to 5μm. The details of U-Pb experimental procedure are as described in [2-4].

Results: Serra Pelada is a clast-rich breccia containing a variety of minerals and lithic clasts in a fine-medium grained matrix. The clasts and matrix are dominated by pyroxene and plagioclase, with minor to trace amounts of ilmenite, silica, chromite, FeNi metal, troilite, phosphate and zircon. The lithic clasts are also observed, including basalts, gabbros and impact melt clasts. The medium grained basaltic clasts typically have needles of plagioclase with subophitic texture. The gabbroic clasts are coarse grained with variable texture from subophitic to equigranular. Serra Pelada also contains minor impact melt clasts which have mineral and lithic clasts set in a fine grained matrix. Cr and O isotope compositions suggest that Serra Pelada is an anomalous eucrite, similar to NWA 8671. Therefore it is unlikely associated with asteroid 4 Vesta, contrary to the common assumption for other normal eucrites [5], but instead must be coming from a different parent body.

Eighteen analyses of U-Pb isotopic compositions were performed on two zircon grains in Serra Pelada. Both of these zircon grains are irregular in shape. One zircon grain encloses ilmenite as inclusions (Fig.1a), and the other zircon grain is associated with plagioclase (Fig.1b). Uranium and thorium concentrations are variable from 26-110 ppm, and 4-37 ppm, respectively. The Th/U ratios range from 0.14 to 0.72.

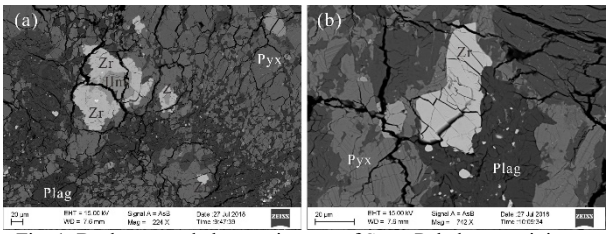

Fig. 1. Backscattered electron images of Serra Pelada, containing pyroxene (Pyx), plagioclase (Plag), ilmenite (Ilm) and zircon (Zr).

The U-Pb data give a concordia age of 4554±14 Ma (Fig.2a). There was no significant Pb-loss from the zircon grains, with a corresponding $^{207}Pb/^{206}Pb$ age of 4556.0 ± 6.1 Ma (Fig.2b), indicating that the U-Pb system of Serra Pelada zircon was not disturbed during the late impact or thermal events. We therefore infer that the $^{207}Pb/^{206}Pb$ date of zircons records the primary crystallization age.

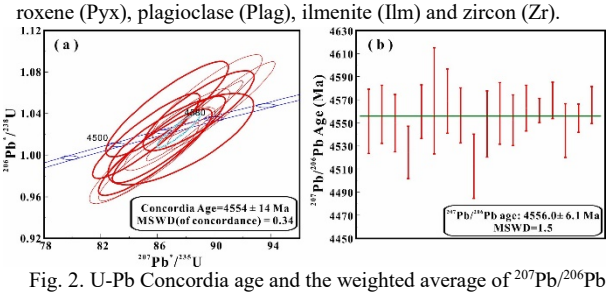

Fig. 2. U-Pb Concordia age and the weighted average of $^{207}Pb/^{206}Pb$ age are determined in Serra Pelada zircon. Uncertainties are 2σ.

Eucrites represent the remnants of the early magmatic activies of the Solar System. Previous studies have obtained U-Pb zircon age for eucrite [4, 6-8], which indicated a peak of basaltic magmatism at 4552 ± 7 Ma [4]. Compared to the literature data, the $^{207}Pb/^{206}Pb$ age of Serra Pelada is also consistent with the other eucrites (Fig.3).

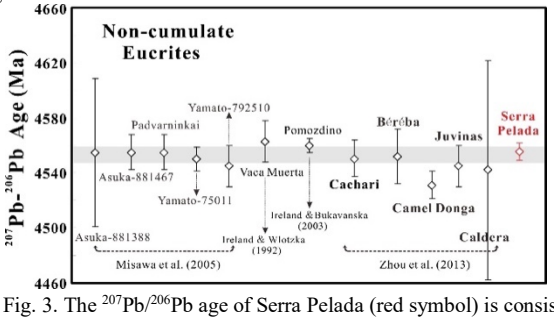

Fig. 3. The $^{207}Pb/^{206}Pb$ age of Serra Pelada (red symbol) is consistent with the other non-cumulate eucrites.

References:

[1] Zucolotto M. E. et al. (2018) *Anais da Academia Brasileira de Ciências* 90:3-16. [2] Li Q. L. et al. (2010) *JAAS,* 25:1107-1113. [3] Liu Y. et al. (2011) *JAAS.* 26:845-851. [4] Zhou Q. et al. (2013) *GCA* 110:152-175. [5] Binzel R.P. and Xu S. (1993) *Science* 260:186-191. [6] Misawa K. et al. (2005) *GCA*, 69:5847-5861. [7] Ireland T.R. and Wlotzka F. (1992) *EPSL,* 109:1-10. [8] Ireland T.R. and Bukavanská M. (2003) *GCA,* 67:4849-4856.