Geophysical Research Abstracts
Vol. 21, EGU2019-10791-1, 2019
EGU General Assembly 2019

Geochemistry and petrography of granitoid basement from the Chicxulub peak-ring

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The peak-ring of the Chicxulub ∼200 km diameter impact structure (Mexico) was drilled during the IODP-ICDP Expedition 364 in 2016, recovering a 829 m continuous core [1]. The "lower peak ring" section (747.0-1334.7 mbsf) consists mainly of granitoid intruded by different types of pre-impact sub-volcanic dikes, and intercalations of impact-melt bearing rocks. This granite dominated unit offers a unique opportunity to study in detail the basement rocks of the Yucatán peninsula and the pre-impact tectonic setting.

The petrography and geochemistry of 40 granitic samples was examined at the University of Vienna and Vrije Universiteit Brussels.

Our samples mainly consist of pervasively deformed, locally micro-brecciated and sheared, coarse-grained leucogranite, with crystals ranging from ∼0.5 to 4 cm in size. The mineral assemblage consists mainly of K-feldspar (∼25-40%), plagioclase (∼25-35%), quartz (∼25-35%), and, to a lesser extent, biotite, often chloritized (∼1-5%). The main accessory minerals are muscovite, apatite, titanite, epidote, zircon, and some opaque minerals. Most of the minerals show signs of shock metamorphism (see details in [2]).

The major element contents of the investigated samples ranges from 69.4 to 77.5 wt.% for SiO_2, from 11.6 to 16.1 wt.% for Al_2O_3, from 3.71 to 5.80 wt.% for Na_2O, and from 2.55 to 5.59 wt.% for K_2O. There is no obvious trend of enrichment/depletion of any specific element with depth. The investigated samples fall within the granite and alkali granite fields in the total alkali vs silica (TAS) diagram. In the A/CNK diagram, our granite samples show values mostly below 1, indicating that they have I-type and metaluminous affinities.

All samples show a weak negative Eu anomaly that is likely indicative of an early crystallization of some plagioclase in the magma chamber. Based on the Nb, Rb, Ta, Y, and Yb content, our samples mainly fall in the volcanic arc granite field, near the limit with the syn-collision granites, with two samples inside this latter field [3]. However, a few samples have distinct La, Ba, Dy, and Yb contents which are more consistent with the within plate granite field, suggesting that there could be at least two different granite generations [4].

The $^{87}Sr/^{86}Sr$ isotopic composition of the granites is ± 0.7077 [4], arguing for a crustal signal, however, Sr is easily affected by alteration and these compositions might not reflect a primary signal. Nd isotopic analyses will be performed to elucidate the isotopic signal.

Our granites, dated at ∼300 to 340 Ma [5] are younger than the ∼500 Ma Pan-African assemblage of the Maya Block forming the main unit of the Northern Yucatán basement and possibly represent a later stage of granitic intrusions.

References: [1] Morgan et al. (2016) *Science, 354*, 878–882. [2] Feignon et al. (2018) *EGU 2018*, 20, Abstract 10750-2. [3] Pearce, et al. (1984) *J. Petrol, 25*, 956–983. [4] de Graaff et al. (2018) *AGU 2018*, Abstract PP53B-01. [5] Xiao et al. (2017) *LPSC XLVIII*, Abstract 1311.