Geophysical Research Abstracts
Vol. 21, EGU2019-15330, 2019
EGU General Assembly 2019

Deciphering U-Pb ages in zircon from Volcano-Sedimentary Complex felsic volcanic rocks. Examples from the Neves-Corvo mining District, Iberian Pyrite Belt, Portugal

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The use of zircon as a geochronometer has become a common use technique to integrate and explain complex geological processes and their time constrains. In the case of volcanic rocks, in opposition to sedimentary rocks, magma sources and chambers should be expected in the vicinity of the volcanic rocks found at/close to surface. Even considering complex tectonic scenarios, during the magma ascending, the volcanic rocks does not expect to carry a long lasting suite of inherited zircons rather than from country rocks (xenocrysts) or inherited from the source rock. Nevertheless, this work shows that the zircon ages found in a volcanic rock do not always accomplish an autocrystic scenario, i.e. an emplacement age. Older zircons are commonly present and may be within the analytical error of the autocrystics counterparts or they could be several million years old.

Felsic volcanic rocks (three rhyolites and one volcaniclastic rock) from the Volcano-Sedimentary Complex of Neves-Corvo Cu-Zn mine district, intercalated with Famennian to Visean age sediments, were dated in order to precise their emplacement age.

The four samples achieved 38, 38 and 28 zircon grains for the rhyolites and 51 for the volcaniclastic rock, representing U-Pb ages within 90-110% concordia, majority of Devonian age. Pre-Devonian inherited zircons (xenocrysts or restitic from source rock) are scattered but present (ca. 452 and 582Ma, ca. 3242 and 3422Ma, ca. 528 and 570Ma, ca. 558, 579, 661 and 792Ma respectively).

The age and error bar distributions shows initial crystallization ages around ca. 398-402Ma, ca. 392-395Ma, ca. 388-390Ma and 397-403Ma (first antecrysts) respectively. The remain results are distributed within the envelope ca. 350-395Ma with best-fit concordia ages of 365.2±1.9Ma, 364.2±2.2Ma, 361.5±2.5Ma, and 366.6±2.0Ma, again respectively. Alternative two younger concordia ages (MSWD >6!) at 353.0±2.7Ma (rhyolite) and 353.7±2.8Ma (volcanoclastic rock) were tested.

The main issue is that these age data represent a long, continuous, progressive tail of results that lasts from 25 to 40 Ma considering the four samples all together. If concordia ages represent the youngest population, they are accepted to be emplacement ages and therefore autocrystic zircons while the remain suite might represent antecrystic ones (not detected using BS images). Different generations can be expected, once the age interval mentioned above seems too long to be explain by a single-event cooling process. Weighted average discrimination analysis allows to stablish several productive crystallization ages which can represent different magmatic pulses or episodes but they not necessary coincide within the 4 samples.

Having in mind that the samples could have been derived from different volcanic centers, several batches of magma have been produced continuously since ca. 400 Ma, some reaching the sub-sea floor becoming interbedded with sediment/epiclastic rocks, some being in under surface/conduit scenario. In consequence, different episodes of volcanism (or a long-last continuous episode?) have occurred for some tens of million years, in which the autocrysts of an older episode might have become to represent the antecryst of a younger one.

(EXPLORA/Alentejo2020-OpALT20-03-0145-FEDER-000025 Project, funded by Alentejo2020/Portugal2020+European Regional Development Fund/ERDF).