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Evaluating protracted concordant U-Pb zircon ages: an example of the Ribeira Orogen, Brazil

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The Ribeira Orogen (RO) in southeastern Brazil was formed in the Neoproterozoic Brasiliano Cycle by the interaction between several cratons, minor cratons, and cratonic fragments during Gondwana assembly culminating in the closure of the Adamastor Ocean.

Main shear zones delimit distinct tectonic domains in the RO, among them the Mongaguá Complex in the Coastal Terrane composed mainly of gneiss-migmatitic and granitic rocks with Paleoproterozoic-to-Neoproterozoic ages.

U-Pb analyses in zircon by the LA-MC-ICP-MS technique were carried out in tonalitic gneiss that yielded complex concordant age spectra between 860 and 740 Ma, revealing that a simple interpretation of the crystallization age is questionable.

Investigating the cause of age dispersion requires careful analysis of the analytical data along with cathodoluminescence images of the zircon crystals. Older ages of 860 and 844 Ma were obtained in oscillatory zoning zircon mantles and may represent either xenocrystals or antecrystals.

Younger ages of 740 Ma and 690 Ma were obtained in homogeneously textured metamorphic rims with both light and dark in the cathodoluminescence images.

For the remaining data, although a Concordia Age of 801.8 ±4.4 Ma with MSWD of 0.57 is perfectly viable, the acquired age may represent the ‘’mixing of two discrete age domains with a small overlap between them: one of 810 Ma and the other of 775 Ma.

Both ages were obtained in oscillatory zoning spots analysis. The older ages do not represent inherited nuclei and, for the younger ones, no metamictization features or fractures are observed, being unlikely to reflect Pb loss. Additionally, they do not seem to represent magmatic autocrystals zircon (775 Ma) overgrowing antecrystal zircons (810 Ma).

Thus, it is most likely that the 775-810 Ma interval characterizes prolonged zircon growth within a single magma reservoir as autocrystals, i.e., reflect the magmatic history indicating prolonged growth of autocrystals with 860-840 Ma antecrystals recycling.