Retrograde metamorphic history of the eclogites from the Acatlán Complex, Mexico

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Acatlán Complex (Puebla state) is the largest outcrop of metamorphic Paleozoic rocks in Mexico. This complex is built by metaigneous and metasedimentary units, including polydeformed metagabbros, metabasites, metapelites, serpentinites and granitoids, which registered at least three independent orogenic events that occurred between the Ordovician-Silurian and the early Permian, including the Acatecan Orogen of Early Mississippian age, which reached eclogitic metamorphic peak conditions at up to 22 kbar and 760 °C (Hernández-Uribe *et al.*, 2018). This lithological and structural diversity has been interpreted as evidence for tectonic processes that involved a complete Wilson cycle, as well as accretionary processes and the subduction of Paleozoic global oceans (*e.g.*, Nance *et al.*, 2006).

Here, we present the results of our multi-disciplinary study, including field observations and multi-technique microstructural analysis – *i.e.*, electron microprobe analysis and detailed compositional mapping processing –. We focused on the metamorphic retrogression of the Acatlán Complex eclogites and some associated lithologies, such as chloritoid-rutile-garnet metapelites.

Our observations on the eclogites suggest that their metamorphic retrogression (MR) and subsequent exhumation took place in at least three stages preserved in different kinds of microstructures grouped as follows: i) MR-1, characterized by the formation of Cpx + Pl symplectites after omphacite; ii) MR-2, characterized by the formation of amphibole pseudomorphs after Cpx + Pl symplectites and Pl + Ep coronae surrounding garnet; iii) MR-3, defined by the albitization and chloritization of MR-2 microstructures.

On the other hand, our observations on the metapelites reveal that their complex metamorphic history -including part of their metamorphic retrogression- is preserved as: i) two compositionally distinguishable generations of garnet, and ii) compositional oscillatory patterns of manganese and Iron in some garnet crystals.

Additionally, we present the preliminary results of geothermobarometry and thermodynamic modelling applied to constrain the P-T conditions of MR-1 and MR-2.

Our data represent the basis for the reconstruction of critical retrograde segments for the P-T trajectories followed by the Acatlán Complex eclogitic lithologies, and provide new elements that could help to solve how HP-rocks buried more than 75 km deep were exhumed and brought back to the surface.

Hernández-Uribe, D., Gutiérrez-Aguilar, F., Mattinson, C.G., Palin, R.M. & Neill, O.K., 2019. A new record of deeper and colder subduction in the Acatlán complex, Mexico: Evidence from phase equilibrium modelling and Zr-in-rutile thermometry. *Lithos*, 324-325, 551-568.

Nance, R.D., Miller, B.V., Keppie, J.D., Murphy, J.B. & Dostal, J., 2006. Acatlán Complex, southern Mexico: Record spanning the assembly and breakup of Pangea. *Geology*, 34, 857-860.