

Intra-oceanic subduction initiation recorded by the metamorphic sole of the New Caledonia ophiolite – preliminary structural and age constraints

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BACKGROUND

The New Caledonia ophiolite formed in a supra-subduction zone setting in the vicinity of an active spreading centre. A metamorphic sole, which represents the ancient subduction interface, is locally preserved beneath the ophiolite. Unravelling its tectono-metamorphic record is essential in order to determine the timing of subduction initiation and the tectonic processes operating at the plate interface during the early stages of subduction.

WHY STUDY METAMORPHIC SOLES?

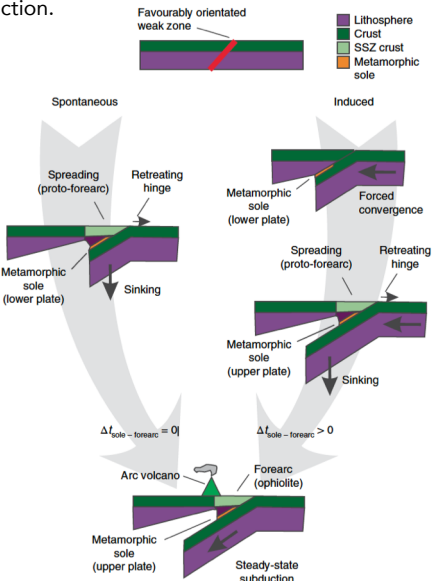
Metamorphic soles are thin (<500 m), fault-bounded sheets of highly deformed meta-volcanic and meta-sedimentary rocks that structurally underlie many supra-subduction zone ophiolites. They are interpreted to be derived from the top of an oceanic slab that accreted to the base of the still hot overriding plate in the nascent stages of intra-oceanic subduction.

Date timing of subduction initiation depending on the presence of the earliest metamorphic minerals that form in soles (e.g., garnet).

Constrain the kinematics and deformation regime at the plate interface during subduction initiation.

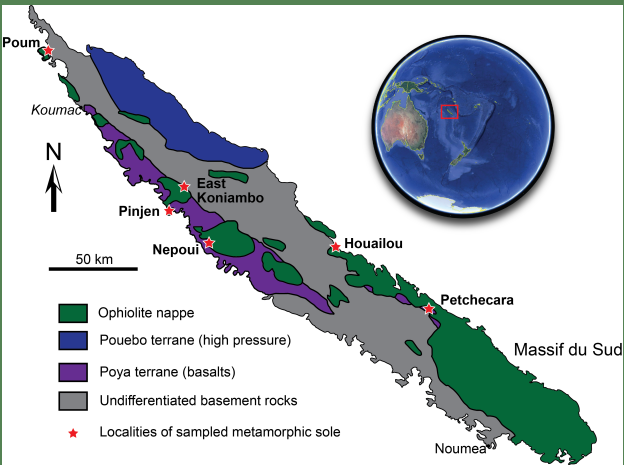
Understand amphibole deformation and how the mechanical behavior of amphibole-bearing rocks may affect plate interface rheology during the incipient stages of subduction.

The spatiotemporal relationships between prograde mineral growth in the sole and crystallization of forearc crust can be used to discern between **spontaneous vs. induced subduction initiation** (Guilmette et al., 2018).

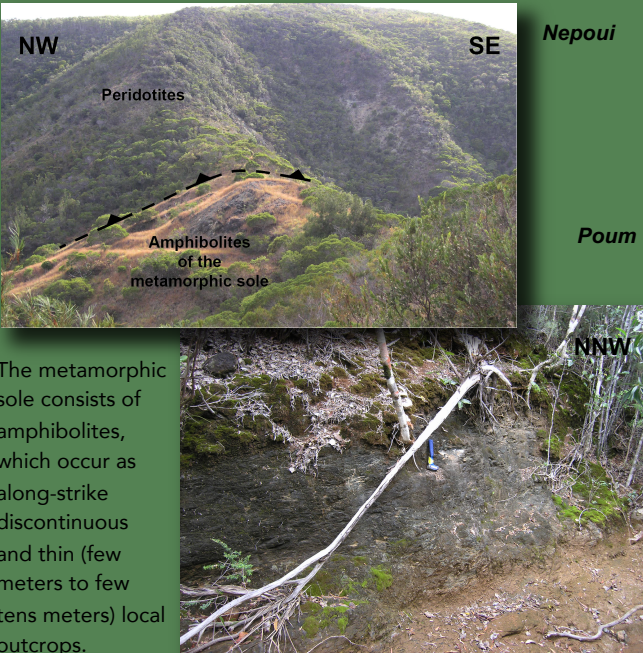


NEW CALEDONIA

Exposures of the metamorphic sole (red stars) are scattered across the island, over an area of 160 km * 50 km. We have sampled and studied amphibole-bearing rocks of the metamorphic sole that crop out in three newly found and three previously known localities.



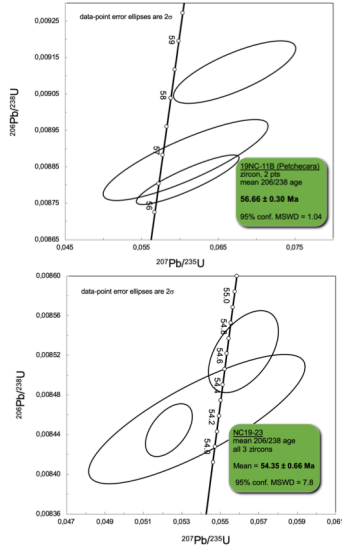
THE METAMORPHIC SOLE



The metamorphic sole consists of amphibolites, which occur as along-strike discontinuous and thin (few meters to few tens meters) local outcrops.

RESULTS

U-Pb zircon ID-TIMS geochronology



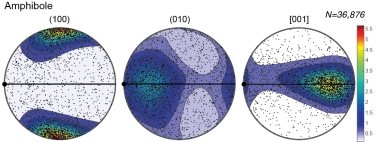
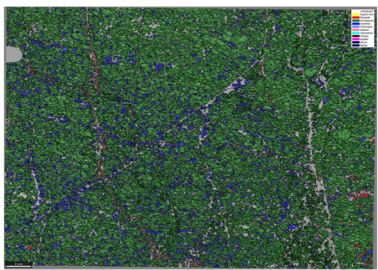
Zircons from the metamorphic sole yield a U-Pb age of **56.7±0.3 Ma**. We interpret this age as crystallization of melt segregations within the metamorphic sole. Zircons from two other localities (Poum and Pinjen) yield overlapping ages. The obtained ages date post-peak conditions rather than burial, thereby underestimating the age of sole formation by a yet-unknown amount of time.

Zircons from a dyke intruding the forearc region of the ancient subduction zone yield a U-Pb age of **54.4±0.7 Ma**. We interpret this age to represent subduction-related magmatism in the forearc as the subduction zone matured.

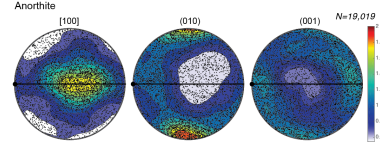
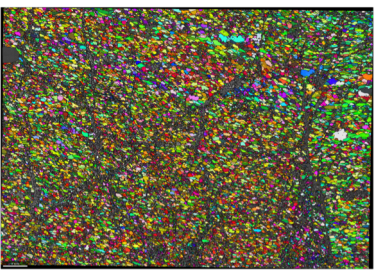
These preliminary results may indicate that there is a time lag between sole formation and forearc magmatism, but more age constraints are needed.

Microstructural data show well-developed shape preferred orientations, and symmetric crystallographic preferred orientations for amphibole, plagioclase and clinopyroxene.

EBSD Phase Map



EBSD Amphibole Crystal Orientation Map



OUTLOOK

- Petrology and thermodynamic modelling
- Dating of grt-bearing samples

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