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Initiation of continental accretion: metamorphic conditions

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The physical processes involved at the beginning of the continental collision are largely unknown because they are transient and therefore hardly identifiable from the rock record. Despite the importance of key parameters for understanding mountain building processes, especially the formation of deep mountain roots and their impacts on earthquakes nucleation, rock/fluid transfers and oil/gas resources in the continental crust, observations from the earliest collision stages remain fragmentary.

Here, we focus on the example of Taiwan, a young and active mountain belt where the transition from oceanic subduction, accretion of the first continental margin to mature collision can be followed in space and time. We present preliminary results and provide key questions regarding the reconstruction of time-pressure-temperature paths of rocks & fluids to allow discriminating between rift-related thermal/rheological inheritance and burial/heating phases during convergence.

Previous studies have focused on peak temperatures analyzed by Raman Spectrometry of Carbonaceous Matter from the deeper structural layers exposed in the Central Range of Taiwan. In the pre-rift sediments, these studies reported a positive gradient from West to Est, and values from <330 to 520 °C. We detect from our preliminary analyses of the Miocene “post-rift” sediments, a trend of increasing temperature from 170 to 340 °C northwards. These temperature data are discussed against key structural features recognized in the field and available low-temperature thermochronological constraints. We show that our RSCM temperatures cannot directly be interpreted in terms of syn-convergence nappe stacking only and must reflect a component of initial (pre-collisional) high-geothermal gradients (up to 60°C/km) known in the region, and higher temperature closer to the pre-rift units. Cross sections and maps with high resolution peak temperatures are in process as well as pressure estimations to determine how the sediments were metamorphosed.

In addition to this work, we report a few inherited temperatures in the 390-570 °C range, indicating recycling of organic matter from metasediments that recorded HT events, likely originated from higher grade metamorphic units of mainland China, which have been eroded and deposited in the post-rift sediments.