104 年度中央研究院深耕計畫

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ACT in Asia: SEA Experiment (亞洲大地構造與岩漿作用研究：東南亞實驗)

[Accretionary and Collisional Tectonics in Asia: Studying Continental Orogeny from Magmatic Perspectives thru South East Asia Experiment]

Project Summary

Asia that consists of numerous ancient cratonic blocks and young mobile belts is the largest composite continent on Earth today. During the Phanerozoic, it was enlarged by successive accretion of dispersed terranes that, associated with opening and closure of the Paleo-Asian and Tethyan oceans, had produced a significant amount of juvenile or mantle-newly-derived continental crust. The Central Asian orogenic belt (CAOB), for instance, is celebrated for its accretionary tectonics and massive juvenile crustal production in the Phanerozoic or, more specifically, in the Paleozoic. Zircon U-Pb and Hf isotope data of "representative" magmatic rocks we have obtained/synthesized from West and South Asia, in particular from Iran and Tibet, suggest that, before continental collisions by Arabia and India, respectively, the eastern Tethyan orogenic belt (ETOB) was characterized not only by Tethyan subductions but also by accretionary orogenic processes that eventually led to significant juvenile crustal production from the Jurassic to Eocene or, in places, to the Oligo/Miocene. Taking together, both CAOB and ETOB appear to have evolved from an accretionary into a collisional system. The zircon Hf isotope data further reveal that in contrast to generating vast portions of juvenile crust in the early, accretionary stages of orogenic development, crustal recycling plays a more substantial role in the later, collisional stages. The latter involves addition of older continental crust material into the mantle, which subsequently melted and caused compositional transformation of the juvenile crust that formed in the accretionary stages. Similar features are observed in young volcanic rocks from the Coastal Range of eastern Taiwan, i.e., the northern Luzon arc or part of the complex subduction/accretion/collision system in **South East Asia (SEA)** that would evolve one day to resemble the CAOB and ETOB by continued collision with the advancing Australian continent, and consequently become a key component of Earth's future supercontinent "Amasia".

Therefore, **SEA** is a modern example and natural laboratory that provides us the best albeit rare opportunity to investigate in greater detail the **ACT (Accretionary and Collisional Tectonics)** processes responsible for not only the mountain building and crustal formation in Asia during the Phanerozoic, but also the continental orogenesis worldwide through the geologic time. **The SEA Experiment** proposed in this project would focus on the following specific issues in different regions:

(1) Neotethyan terrane accretion and subsequent tectonomagmatic evolution in Sumatra.

(2) Multiple plate interactions and resultant magmatism in Sulawesi and neighboring areas.

(3) Pre- to Post-South China Sea opening magmatic records in NE Borneo and adjacent areas.

(4) Subduction initiation, magma genesis and accretionary orogeny in the N Luzon arc system.

(5) Synthesis of the above information for a new comprehension of the Cenozoic tectonic evolution in **SEA**, to explore in more detail how the subduction/accretion/collision evolves over time and space and the oceanic terranes transform to juvenile continental blocks.