The Late Cretaceous Asteroussia event as recorded in the Cyclades: a potential key to Western Tethys tectonic evolution

Sonia Yeung1, Marnie Forster1, Emmanuel Skourtos2, and Gordon Lister3

1Structure Tectonics and Argon Geochronology, Research School of Earth Sciences, Australian National University, Canberra, 2601 Australia (hosonia.yeung@anu.edu.au)
2Section of Dynamic, Tectonic and Applied Geology, Department of Geology and Geoenvironment, National and Kapodistrian University of Athens, Athens 157 72, Greece
3The Virtual Explorer, Clear Range, 2620,NSW, Australia

The Cretaceous arc system formed during closure of West Tethys closure has long been a research focus for crustal geometry and associated ore deposits. Understanding the Africa-Europe motion across time is the key to its resolution. Evidence as to the time that Tethys subduction initiated is preserved in subduction accreted tectonic slices such as in the Gondwanan basement terranes on Ios, Cyclades, Greece. 40Ar/39Ar geochronology in its granitoid basement and the structurally overlying garnet-mica schist tectonic slice identified a Late Cretaceous high pressure, medium temperature (HP–MP) metamorphic event. The timing and metamorphic conditions are comparable with geochronology and metamorphic conditions reported from other Cycladic islands. We suggest the northward extension of the Asteroussia crystalline terrane on Crete should therefore include the Ios basement tectonic slices, thus revising the regional geometry of the terrane stack. The northern part of the Hellenic terrane stack is overlain by individual Cycladic Eclogite-Blueschist terrane slices (e.g., on Ios) and the southern part is underplated by the tectonic units of the external Hellenides (Crete). To make such an architecture possible, we propose a 250-300 km southward jump of the subduction megathrust when the Ios basement terranes were accreted to the European terrane stack. Such a significant leap of the subduction megathrust supports a tectonic mode switch in which crust above the subduction zone was first subjected to shortening followed by a stretching event. Accretion of the Asteroussia slices to the terrane stack likely commenced at or about ~38 Ma. During accretion, the already stretched and exhumed terranes of the Cycladic Eclogite-Blueschist Unit begun to thrust over the newly accreted Ios basement. The subduction jump had likely been accomplished by ~35 Ma, with rollback recommencing after a period of flat slab subduction followed by slab break off in the new subduction zone. This would allow explanation of the extreme extension that exhumed the Ios basement terrane, with the Asteroussia slices defining the core of the Ios metamorphic core complex, followed by the onset of Oligo-Miocene extension and accompanying magmatism in the Cyclades.