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Geochronology of late Variscan magmatism of Sardinia: a review

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Sardinia represents a southern transect of the Variscan Belt and is classically divided from SW to NE into a fold and thrust belt Foreland, Nappe zone and Axial zone. This latter high-grade domain is separated from the Nappe zone by the so-called Posada-Asinara Line. The whole metamorphic basement is intruded by many calc-alkaline coalescent plutons forming the Corsica-Sardinia Batholith. The timing of magmatism, in Sardinia, is broadly referable to a large interval in the range of 320-280 Ma. Recent geological maps coupled to several chronological systematics, point out to recognize two main post-collisional magmatic peaks clustered at about 305 Ma (Older Magmatic Peak, OMP) and at 285 Ma (Young Magmatic Peak, YMP), respectively.

Plutons intruding different parts of the Sardinian basement show different geological styles. Among the OMP, main differences regard: (a) the granodiorite/granite volume ratio in the main plutons; (b) the abundance of peraluminous rock-types; (c) the occurrence of mafic intrusions; (d) the abundance of late-magmatic dyke swarms. The Axial zone is dominated by monzogranites and subordinate granodiorites and leucogranites (320-307 Ma); tonalites and granodiorites (305-300 Ma), along with peraluminous granites, characterize the inner Nappe zone (*i.e.*, Goceano, Baronia, Barbagia). Remarkably, the oldest intrusions (*i.e.*, Barrabisa and Santa Maria: 320 Ma) are foliated and may represent a pre-batholith magmatic phase. Plutons occurring in the external Nappe zone and the Foreland are generally dominated by granodiorites (*e.g.*, Arbus, Ogliastra, Sàrrabus: 305-300 Ma) associated to small gabbro-noritic bodies. The YMP is marked in the Axial zone by large leucogranite intrusions (Monte Lerno); gabbroic intrusions are present at 285-280 Ma. The YMP is dominant in the external Nappe zone and in the Foreland. This peak include monzogranites and leucogranites with minor granodiorites; specific characters are: (a) common occurrence of F-bearing, ferroan, ilmenite-series granitoids; (b) slightly peraluminous character; (c) very shallow emplacement levels, with common greisen alteration; (d) presence of Sn-W-Mo and F ores; (e) association to swarms of tholeiitic mafic dikes. The timing and distribution of Sardinian intrusive magmatism are tentatively framed during the post-collisional evolution of the chain, in response to progressive lithospheric delamination along a N-S direction. In this model, the passive upwelling of hot asthenosphere triggered dehydration melting at lower to intermediate crustal levels, associated with minor melting of the lithospheric mantle. Several major issues emerge from this schematic picture, including (a) the precise timing of the magmatic peaks, (b) the significance of the gap between them, (c) the difference in volumes and spatial distribution of the main rock-suites, (d) the geological and petrological frame at the district- to single pluton-, up to regional scale, and (e) the age of mafic dyke swarms.