Arc magmatic tempos

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An intriguing aspect of arc behavior is arc-scale cyclic magmatism potentially with repeated patterns or tempos. Large geochronologic datasets are needed to study tempos, encouraging the use of U-Pb detrital zircon (d.z.) ages as a proxy for the temporal records of arc magmatism. We compare volcanic/plutonic U-Pb zircon ages to d.z. datasets for Mesozoic North American continental arcs from the Coast Ranges batholith, Sierran and Peninsular Ranges batholiths, and the Coastal batholith, Peru, representing an ~3000 km along-arc record. The d.z. records provide greater detail of the temporal variations, but no quantitative information about magma addition rates. Both datasets indicate that Mesozoic Cordilleran arc magmatism began around ~250-260 Ma, never entirely "turned off" and that tempos are scale-dependent: several magmatic peaks and lulls are roughly synchronous for 3000 km, others synchronous over <1000 km scales, and local variability occurs at ~100 km scales. Durations (wavelengths) of cycles average ~60-70 m.y. during much of the Mesozoic but appear to shorten to ~20-30 m.y. in the Late Cretaceous and Tertiary. Thus causes of magmatic cyclicity are likely varied and both scale and age dependent. Comparison of oceanic and continental arcs will help establish whether lower or upper plate processes control these tempos. But only limited age datasets are presently available for oceanic arcs. These data hint that oceanic arcs have shorter lifespans (<60 m.y.), but may show low amplitude cyclicity over 20-30 m.y. durations. We speculate that lower plate processes generate low amplitude magmatic cyclicity, which is enhanced by feedback processes in upper plates with thick continental sections.