Continent formation by accretion of sub-arc lithosphere

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The construction of continents on accretionary margins involves not only accretion of crustal terranes but also the underlying mantle lithosphere. The ~ 4 million km^2 of continental crust beneath the Zealandia continent is composed of a variety of Cambrian to Mesozoic arc-related terranes accreted to the Jurassic-Cretaceous Gondwana subduction margin, with the continental assemblage (Zealandia) having separated from Australia and Antarctica in the Late Cretaceous. Mineral and whole rock major, minor, trace and isotopic elemental ratios from xenoliths and orogenic peridotites exhumed from under Zealandia show portions of this mantle lithosphere to have moderately- to ultra-depleted compositions, similar to that beneath cratons. Re-depletion model ages, some as old as Archean [1], are not well correlated with depletion indices (Al_2O_3, Mg#, Pt/Ir, etc) and require the rocks underwent (at least) two stages of melt extraction with the second stage likely having occurred during continent construction along the Gondwana margin. We therefore envisage the mantle lithosphere beneath this young continent to have been formed by accretion of sub-arc lithospheres that had were extensively depleted during Mesozoic arc magmatism. The craton-like compositions of the Zealandia peridotites may make this mode of lithosphere formation a modern analogue for making cratonic lithosphere.

[1] Liu, J., Scott, J. M., Martin, C. E., & Pearson, D. G. (2015). *Earth and Planetary Science Letters*, *424*, 109-118.