Significance of Episodic Zircon Age Peaks during the Archean

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With our existing database (~420,000 U/Pb zircon ages), 13 geographically widespread age peaks are recognized prior to 2.7 Ga. As with the post-Archean, most of these age peaks are transferred into younger sediments by detrital zircons suggesting they are not due to selective recycling of continental crust into the mantle. The widespread geographic distribution of felsic rocks 2.8-3.3 Ga, yet low abundances of detrital zircons, suggests a widespread distribution of small "islands" of continental crust, but an overall small volume. Supporting this observation is the absence of geochemical evidence in basalts for recycling of continental crust into the mantle prior to ~ 2.7 Ga. It is not until during and after the 2.7-Ga global event that we have evidence for both widespread distribution and a significant volume of continental crust. Most Archean zircon age peaks have associated LIP events (with ≥ 6 LIPs per event) and cross-correlation analysis shows that LIP peaks tend to precede zircon peaks by about 30 Myr. Monte Carlo simulations combined with standard correlation analysis show weak to moderate correlations between igneous and detrital zircon detrended data sets and with LIP events. Spectral analysis shows a 115-120 Myr cycle in all data (including LIP events) and a 91 Myr cycle in detrital zircons. Both cycles are significantly shorter than the 273-Myr cycle that appears after 2.7 Ga. The shorter cycles before the 2.7-Ga event are consistent with thermal plume generation in a hotter mantle, and the relationship between zircon and LIP event age peaks indicates that plumes may be influential in generating the first continental crust. Cyclical variation in zircon and LIP peak ages suggests that episodic destabilization in the lowermost mantle began prior to the 2.7-Ga event, before plate tectonics became widespread (2 Ga), and before large volumes of continental crust were produced (2.5-2.7 Ga).

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