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ZIRCON PETROCHRONOLOGY: GRANITOID MELTING CONDITIONS AND CONTINENTAL EVOLUTION

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We present zircon geochronology and trace element geochemistry on 4 new detrital rocks (two modern sediments and two Archean metasedimentary rocks) together with a global compilation of published single zircon detrital chronology and trace chemistry data. Our analysis consists of 5450 individual grains. Together, these are used to seek temporal trends in granitoid chemistry and thermometry that could constrain major global changes in style of magmatism, tectonism or crustal thickness in the continents. Zircons of all ages from 4.4 Ga to today exist in this geologic archive. After discarding discordant grains, more than 98 % of the remaining grains are high temperature (Ti-in-zircon thermometry values over 650 ^{0}C). The great majority of remaining zircons are in the 650-850 ^{0}C temperature range consistent with zircon formation from intermediate to silicic magmas; most of these were likely intrusive magmatic rocks. Magmatic temperatures increased over time for the first 1.2 Gy of Earth's history after which they stayed constant before decreasing toward the more recent past. U/Th ratios less than 5 in the overwhelming majority of grains are consistent with a magmatic origin. La/Yb, Sm/Yb and Eu* values are relatively constant throughout the history of the Earth suggesting that most granitoids formed at or evolved from magmatic reservoirs located at depths of 35-45 km in the presence of amphibole, garnet and limited plagioclase. Such reservoirs are common today in hot deep crustal environments beneath some of the thicker island arcs and all continental magmatic arcs above subduction zones. Processes other than modern day style subduction may have buffered the origin of granitoids in the early Earth but temperatures, depths and the presence of water arbitrated by the presence of amphibole were similar. These results also suggest that continental crustal thickness averages in areas that produced zircons and their host granitoids were similar to today's global average throughout the 4.4 Gy time period covered by the zircon archive. There is also no correlation between zircon chemistry over time and the assembly of supercontinents.

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