Investigating Carbonaceous Materials Preserved in Hadean Zircons

ELIZABETH A. BELL[1]*, PATRICK BOEHNKE[1], T. MARK HARRISON[1] AND ANDREW STEELE[2]

[1]Dept. of Earth, Planetary, and Space Sciences, University of California, Los Angeles; *ebell21@ucla.edu
[2]Geophyscial Laboratory, Carnegie Institute of Washington

Our understanding of when life emerged on Earth is limited by the nature of the geologic record. As rocks become sparser with age, the chances of preserving fossil or chemofossil evidence of a biosphere is greatly diminished. Coupled with the metamorphosed nature of early Archean rocks, the search for evidence of life's origins requires us to turn to unconventional records. For example, graphitic inclusions in apatite from ≥3.83 Ga rocks from southwest Greenland have highly negative $\delta^{13}C$ suggestive of a biologic origin[1]. Detrital zircons from Jack Hills, Western Australia, range up to nearly 4.4 Ga and host diverse mineral inclusions[2]. We examined 46 >4 Ga Jack Hills zircons (prepared using non-C-bearing polishing grit) using Raman spectroscopy and found C-bearing inclusions in 3. One such sample (RSES77-5.7) coexists with rutile, quartz, Fe-oxides, and muscovite in a 4.06 Ga zircon. Another (RSES61-18.8) occurs alone in a 4.1 Ga zircon. These observations contrast with an earlier report[3] that found a much higher occurrence of graphitic inclusions as well as the presence of diamonds. However, that study was found to be compromised by contamination during sample preparation[4], warranting this re-examination. We conclude that Hadean zircons do contain carbonaceous inclusions, albeit at lower abundance than previously claimed. Pending SIMS C isotopic analyses should provide the first clues as to the nature of the Hadean carbon cycle.

[1] Mojzsis *et al* (1996), *Nature* **384**, 55-59 [2] Hopkins *et al* (2008), *Nature* **456**, 493-496 [3] Menneken *et al* (2007), *Nature* **448**, 917-920 [4] Dobrzhinetskaya *et al* (2014), *EPSL* **387**, 212-218