Oldest terrestrial diamonds in zircon from Jack Hills, Western Australia

M. MENNEKEN[1], A.A. NEMCHIN[2], T. GEISLER[1], R.T. PIDGEON[2] AND S.A. WILDE[2]

[1]Institut für Mineralogie, Westfälische Willhelms-Universität Corrensstr.24, 48149 Münster, Germany

[2]Department of Applied Geology, Western Australian School of Mines, Curtin University of Technology, Bentley, WA, 6102, Australia

Recent geochemical and mineralogical studies of >3,900 Myrs old, detrital zircons from the Jack Hills metasedimentary belt, Yilgarn Craton, Western Australia, implied that granitic, continental crust and oceans on the Earth already existed as early as 4,400 Ma. However, this hypothesis is still a matter of debate as it contrasts with the conventional view that early Earth's evolution was dominated by mafic and ultramafic magmatism. Importantly, we have now discovered diamond inclusions in Jack Hills zircons using micro-Raman spectroscopy. The ages of the diamond-bearing zircons range from 3 to >4 Ga, thus providing a completely new dimension in the formulation of ideas regarding the evolution of the early Earth. This spread of ages indicates that either the conditions required for diamond formation were repeated several times during early Earth history or that there was significant recycling of ancient diamond. Most diamonds are surrounded by graphite, suggesting a retrograde diamond-to-graphite transformation. Graphite is known to be associated with metamorphic diamonds formed during ultra-high pressure (UHP) metamorphism. This, together with other mineralogical features, demonstrates that the Jack Hills diamonds most closely resemble diamonds formed during UHP metamorphism. Unless conditions on the early Earth were unique, this implies the presence of a relatively thick continental lithosphere and that crust-mantle interaction occurred on Earth as early as ~4.2 Ga.

References

Valley, J. W., Cavosie, A. J., Fu, B., Peck, W. H., (2006) Science 312, 1139a.

Watson, E. B., Harrison, T. M. (2005) Science 308, 841-844.

Wilde, S. A., Valley, J. W., Peck, W. H., Graham, C. (2001) Nature 409, 175-178.

Organic speciation of hydrocarbon-derived carbonate chimneys (Gulf of Cadiz, SW Iberia)

C. MENOR-SALVÁN[1], M. RUIZ-BERMEJO[1], R. MERINERO[2], R. LUNAR[2] AND J. MARTÍNEZ-FRIAS[1]

[1]Centro de Astrobiología (CSIC-INTA). Ctra. Torrejón-Ajalvir km. 4.2, Torrejón de Ardoz. E-28850 (Spain); menorsc@inta.es

[2]Departamento de Cristalografía y Mineralogía, Facultad de Ciencias Geológicas, Universidad Complutense de Madrid, 28040, Madrid, Spain

Dolomite-rich chimneys associated with hydrocarbon-rich fluid venting were discovered in September 2000 in the Gulf of Cadiz. Chimneys show a wide variety of shapes and range in size from several centimetres to a few decimetres. Basically, they are made of a fine groundmass of major Fe-rich dolomite, ankerite and calcite, small grains of quartz and phyllosilicates, and foraminifer tests and ostracod shells. The possibility of anaerobic oxidation of methane mediated by a community of anaerobic methanotrophic archaea and sulphate reducing bacteria, along with the proposal that the iron oxides and sulphides, present in the carbonate matrix of the chimneys, are probably formed by biomineralization processes justify the organic speciation of samples and study of biomarkers. We found linear hydrocarbons with C<20, isoprenoids but not hopanoids and PAHs as indicators of petroleum or anthropogenic contaminations. Is interesting the presence of a complete series of terminal monochloroalkanes in the same C range of the n-alkanes found in the sample (Fig 1.) We suggest that chloroalkanes were formed during the hydrothermal process in the seafloor.

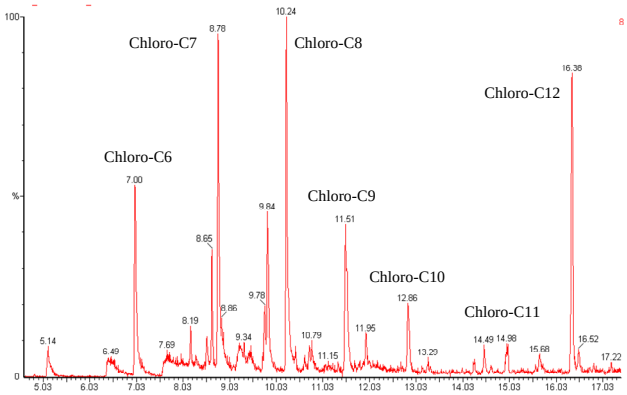

Figure 1: SPME-GC/MS chromatogram showing the 1-chloro-n-alkanes profile in hydrothermal chimney samples.