Organic geochemistry of the Boltysh impact crater, Ukraine

Conference or Workshop Item

Organic geochemistry of the Boltysh impact crater, Ukraine

Jonathan S. Watson [a,b,*], Iain Gilmour [a], Simon P. Kelley [b], David W. Jolley [c]

[a] *Planetary and Space Sciences Research Institute, The Open University, Milton Keynes, MK7 6AA, UK (* corresponding author: j.watson@open.ac.uk)*
[b] *Department of Earth and Environmental Sciences, The Open University, Milton Keynes, MK7 6AA, UK*
[c] *Department of Geology and Petroleum Geology, University of Aberdeen, AB24 3UE, UK.*

The Boltysh crater has been know for several decades and was originally drilled in the 1960s - 1980s in a study of economic oil shale deposits. Unfortunately, the cores were not curated and have been lost. However we have recently re-drilled the impact crater and have recovered a near continuous record of ~400 m of organic rich sediments deposited in a deep isolated lake which overly the basement rocks spanning a period ~10 Ma.

The Boltysh impact crater, centred at 48°54'N and 32°15'E is a complex impact structure formed on the basement rocks of the Ukrainian shield. The age of the impact is 65.17±0.64 Ma [1]. At 24km diameter, the impact is unlikely to have contributed substantially to the worldwide devastation at the end of the Cretaceous. However, the precise age of the Boltysh impact relative to the Chicxulub impact and its location on a stable low lying coastal plain which allowed formation of the post-impact crater lake make it a particularly important locality. After the impact, the crater quickly filled with water, and the crater lake received sediment input from the surrounding land surface for a period >10 Ma [2]. These strata contain a valuable record of Paleogene environmental change in central Europe, and one of very few terrestrial records of the KT event. This pre-eminent record of the Paleogene of central Europe can help us to answer several related scientific questions. What is the relative age of Boltysh compared with Chicxulub? How long was the hydrothermal system active for after the impact event? How did the devastated area surrounding the crater recover, and how rapid was the recovery?

The first sediments to be deposited in the crater lake were a series of relatively thin turbidites, the sediments then become organic rich shales and oil shales. Within the core there is ~400 m of organic rich shales/oil shales spanning a period of ~10 Ma some of which contain macrofossils such as ostracods, fish and plant fossils. Preliminary palynological studies suggest initial sedimentation was slow after the impact followed by more rapid sedimentation through the Late Paleocene.

Hydrocarbons extracted from these samples are commonly dominated by terrestrial *n*-alkanes (Fig 1), Hopanes (including 3-methylhopanes) and steranes are also abundant and indicate the immaturity of the samples. The immaturity of samples is also evident from the abundance of hopenes, sterenes and oleanenes especially in the upper section of the core. In some of the oil shales the hopenes and sterenes are the most abundant hydrocarbons present. There is variation in the distribution of hydrocarbons/biomarkers and palynology throughout the core caused by changing inputs and environmental conditions.

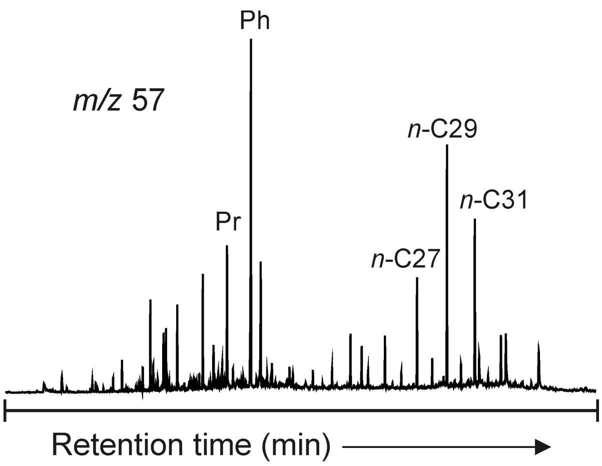

Fig. 1. Typical partial chromatogram (m/z 57) of a solvent extract from the middle of the core.

References

[1] Kelley, S.P., Gurov, E. (2002) Meteorit. Planet. Sci. 37, 1031–1043.

[2] Gurov, E.P. et al. (2006). In: Cockell, C., Koeberl, C., Gilmour, I. (Eds.), Biological Processes Associated with Impact Events, Spinger-Verlag, Berlin pp. 335-358.