



The aftermath of a mass extinction: recovery of the Earth system following the K/Pg mass extinction and Dan-C2 hyperthermal events

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- Opportunity to study lake sediments that record environmental change during the lower Palaeocene
- Opportunity to gain a very high level of experience in the application of stable isotope and organic geochemical techniques to palaeoclimate and palaeoenvironmental problems
- Advanced training in stable isotope and organic mass spectrometry

The long term recovery of the Earth system in the aftermath of the Chicxulub impact is not well understood and the majority of studies have focussed on the marine ecosystem where there is conflicting evidence for the timescales of ecological and biogeochemical recovery post the K/Pg ranging from thousands to hundreds of thousands of years [1, 2]. Some 300 ka after the K/Pg there is emerging evidence for a transient ocean warming event, the Dan-C2, [3] and a second disruption of carbon reservoirs.

The central aim of this project is to understand how the Earth system recovered from these two events and to resolve the debate as to timescales of recovery and the extent to which ecological and biogeochemical recovery are linked. To do this we will make use of a unique geological record: the 596 m core recovered during the scientific drilling of the Boltysh impact crater in the Ukraine which provides a near continuous record of sedimentation spanning around 1 Ma immediately above the K/Pg with some 120 m of sediment spanning the interval between the K/Pg and Dan-C2 which will be the focus of this study. These predominantly fresh-water lacustrine sediments are organic rich and of very low thermal maturity providing an ideal suite of samples for isotopic and molecular proxy studies.

The student will be able to draw on detailed palynological investigations of the same samples being undertaken at the University of Aberdeen thereby providing a unique tie-in between bulk and molecular C isotopic and molecular proxies of climate change with robust biostratigraphic controls. The student may also draw on data from other K/Pg boundary sites as appropriate.

Specific objectives:

- To provide an integrated and biostratigraphically controlled molecular isotopic and molecular proxy record of climate change in the lowermost Danian from north-central Tethys.
- To establish the relationship between ecological recovery and biogeochemical recovery post the K/Pg and Dan-C2 events
- To relate the lacustrine record obtained from Boltysh to the marine record of other workers.

The Department has a thriving postgraduate community and the postgraduate training programme provides a full range of courses covering: research techniques, scientific methods, information technology, communication and interpersonal skills, which are tailored to the needs of each student.

If you would like to apply or have any queries about this project please contact the supervisors either by email s.p.kelley@open.ac.uk or by writing to the address above enclosing a full academic CV and the names and addresses of three academic referees.

References: [1] D'Hondt, S., Consequences of the Cretaceous/Paleogene mass extinction for marine ecosystems. *Ann. Rev.*, 2005. **36**: 295–317. [2] Sepúlveda, J., *et al.*, Rapid resurgence of marine productivity after the Cretaceous-Paleogene mass extinction. *Science*, 2009. **326**: 129–132. [3] Quilley, F., *et al.*, Transient ocean warming and shifts in carbon reservoirs during the early Danian. *EPSL*, 2008, **265**(3-4): 600–615.