

A shocking state: novel mineralogical and geochemical signatures of terrestrial impact craters

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Impact cratering has played a major role in the development of the surfaces of Earth, the terrestrial planets and innumerable minor solar system bodies. It has also been a key process in the history of life on Earth, and may also have played a role in the evolution of life on other planets. In order to understand better the significance of impacts throughout Earth's history it is essential to be able to identify craters together with their associated ejecta layers, and to accurately determine their ages. This becomes progressively difficult with older impacts. In this project we aim to develop and apply a suite of novel microanalytical techniques for identifying and dating ancient impact craters and their deposits, using examples from the Fennoscandian shield.

In this project we will specifically focus on the response of K-rich feldspars to shock metamorphism, and the use of K-rich feldspars as indicators of impact events. K-rich feldspars are also suitable for dating impacts using argon isotope techniques, and it is crucial to understand how the argon is retained in shocked or impact melted K-rich feldspars, since the system is often complicated by subsequent hydrothermal or tectonic events. The work will focus on the old continental crystalline basement of the Fennoscandian region (e.g. Sweden, Finland, Karelia, parts of Norway), where there are at least 30 confirmed impact craters and 50 candidate structures of impact origin. Argon isotope techniques will be used to determine the age and thermal evolution of crater rocks and any associated impact melts. Parallel microchemical and microtextural studies will be used to assess the degree of shock metamorphism of the target rocks from the presence and properties of structures such as planar deformation features, planar fractures and diaplectic glasses, focussing on the shock behaviour of K-rich feldspars. This work has particular implications for the retention and resetting of the argon isotope system in shocked K-rich feldspars and K-rich impact melts. Results from this work will then be compared with analysis of similar unshocked samples together with minerals in impact ejecta deposits including the Precambrian Stac Fada Member of Scotland.

This project offers the opportunity to undertake fieldwork at a variety of impact craters in Scandinavia, including the Dellen impact structure in Sweden and the Gardnos impact structure in Norway, and gain experience in a range of state of the art microanalytical techniques at the

University of Glasgow and at the Scottish Universities Environmental Research Center (East Kilbride). Upon successful completion of the project the student will be well suited to careers in fields such as mineral exploration and planetary science.

About us: In Glasgow, the student will join the Graduate Schools of the School of Geographical and Earth Sciences (up to 20 new PhD students starting in autumn 2011) and the broader College of Science and Engineering; both of these have thriving post-graduate research communities. The Glasgow Earth Systems Research Group (ESRG) is a vibrant research group that has weekly meetings and one or two research 'away-days' annually. ESRG is supported by state-of-the-art laboratories on the Glasgow campus and at the Scottish Universities Environmental Research Centre in Glasgow's southern suburbs.

Application procedure

Potential applicants may contact the supervisors for further information, but should make formal applications using the website of the College of Science and Engineering

(<http://www.gla.ac.uk/colleges/scienceengineering/graduateschool/prospectivestudents/essentialinformation/>). The closing date for applications is **29 July 2011**.