



Structural E-Technical Division Talk

Directly dating brittle deformation using U-Pb carbonate and K-Ar dating

Speaker: Catherine Mottram (University of Portsmouth) and Dawn Kellett (Geological Survey of Canada)

Date: Friday, May 20, 2022 | 12:00pm – 1:00pm (MST)

Abstract:

While ductile shear zones typically produce a penetrative fabric of recrystallized minerals, some of which can be dated with radiometric dating methods, brittle fault zones do not involve wall rock recrystallization, and hence direct dating of faults presents a challenge. However, fault zones do produce some low-temperature mineral products, with clay-rich gouge zones and slickenfibres being relatively common. K-rich illite clay in fault gouge presents a direct dating opportunity, and emerging techniques have recently been developed for directly-dating carbonate minerals, which commonly precipitate as slickenfibres and in fault-related veins. These approaches have opened up a whole new realm of tectonic investigation in the upper crust.

This talk will explore the principles behind and approaches to directly dating brittle faults, specifically using the U-Pb carbonate dating and K-Ar fault gouge dating systems. We will discuss the methodology, best practices, and approaches to interpretation of K-Ar illite dating and calcite U-Pb dating for providing timing constraints for upper crustal deformation, as well as fluid flow and mineralisation events. We will use examples from the North Anatolian Fault, and a large-scale strike-slip fault in the Yukon, Canadian Cordillera to demonstrate how these dating methods can be successfully used to reconstruct the displacement history of these various first-order structures, and to discuss the strengths and weaknesses of these approaches. The results can be used to examine how orogenic stress is spatially and temporally accommodated along major seismically-active, continental-scale faults.



Biographies:

Catherine Mottram



Catherine completed her undergraduate studies at the University of St Andrews before moving to the Open University to work on her PhD in Himalayan tectonics. During her PhD Catherine had an incredible time out in the eastern Himalaya- studying and collecting some of the most beautiful rocks on Earth, aided by many cups of Darjeeling tea! Catherine went onto spent time as a Fulbright postdoctoral scholar at the University of Santa Barbara, USA and a Killam postdoctoral fellow at Dalhousie University in Canada before moving to the University of Portsmouth in 2017 where Catherine is currently a Senior Lecturer in Structural Geology and Tectonics and Course Lead for Geology.

Catherine's research focuses on faults and dating deformation in the crust- investigating the hows, whys, whens and wheres of some of the most important processes for deforming our planet. Catherine's research has taken her all over the world from India, Bhutan,, to Greece, the Alps and the Yukon in Canada. Catherine is passionate about science communication and enthusing others to love rocks as much as her. When not looking at rocks, Catherine can be found exploring the wilds of Scotland, camping, hiking, paddleboarding, jogging, playing her violin, or hanging out with her cat- Lord Clarence.

Dawn Kellett



Dr. Dawn Kellett is a Research Scientist with the Geological Survey of Canada (since 2011), with previous degrees from UBC, Queen's U and Dalhousie U, and post-doctoral work at U California-Santa Barbara.

Kellett's research focuses on orogen deformation and exhumation and their relationships to ore deposits by applying a wide range of structural, metamorphic and especially geochronological methods. Her work spans the Cordilleran, Appalachian, Trans-Hudson and Himalayan orogens. Kellett is Associate Editor for Journal of Geophysical Research-Solid Earth and Canadian Journal of Earth Sciences, and has been Chair of the Canadian Tectonics Group division of the Geological Association of Canada since 2016. She holds adjunct professor positions at UBC, Saint Mary's U, Dalhousie U, and Queen's U.