Fluid temperature and composition associated with displacement of the Chelungpu fault in Taiwan

TZU-HAO HUANG[1], PEI-LING WANG[2], MEI-FEI CHU[3], LI-HUNG LIN[4], CÉDRIC JOHN[5]

[1] Institute of Oceanography, National Taiwan University, Taipei, Taiwan (jack45122002@gmail.com)
[2] Institute of Oceanography, National Taiwan University, Taipei, Taiwan (plwang@ntu.edu.tw)
[3] Institute of Oceanography, National Taiwan University, Taipei, Taiwan (mfchu@ntu.edu.tw)
[4] Department of Geosciences, National Taiwan University, Taipei, Taiwan (lhlin@ntu.edu.tw)
[5] Department of Earth Science and Engineering, Imperial College London, London, UK (cedric.john@imperial.ac.uk)

Fault activities play a key role in the evolution of Earth's crust. Fluid appears to be one of the most important factors controlling the behaviour of the fault zone. However, the exact role of the fluid characteristic related to faulting mechanism remains largely unknown. This study aims to constrain the compositions and temperatures of fluids related to the fault displacement using the isotopic compositions and elemental abundances of calcite veins sampled from the Taiwan Chelungpu-fault Drilling project. The analyses yielded that Fe, Mg, Li, Be, Pb, Rb and Cs concentrations were higher in calcite veins from the Chelungpu fault zone than those from the adjacent formations. For comparison, Sr concentrations exhibited a pattern contrast from the elements described above. Carbonate clumped isotope analysis yielded that parts of vein carbonate around the fault zone precipitated at temperatures of less than 100 °C and from fluids more depleted in ^{18}O (generally less than 0 ‰). This pattern again was in contrast to that in the adjacent formations (generally greater than 100 °C and up to 5 ‰). Such isotopic and elemental variations across the fault domain suggest that the fault activities facilitate to mobilize elements and provide a fluid conduit that enables the circulation and infiltration of shallow-ranging meteoric water into great depths.