Fluid circulation through active faults in a transpressive setting - Haiti

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Haiti consists of a southwest verging fold-and-thrust belt in the north, with the Chaîne des Matheux acting as the southernmost onshore thrust sheet. This system is bounded to the south by a seismogenic transpressive fault zone, the left-lateral Enriquillo-Plantain Garden fault zone (EPGFZ). The 2010 Haiti earthquake displayed oblique-reverse rupturing of a fault segment at the junction of these two fault system.

Fluids and deformation interacting at crustal fault zones influence fluid circulation and geochemistry, while fluid pressure and mineralogy affect fault behavior. Our study aims at characterizing the fluid circulation through the Haitian fault systems, both in the past and at present, a prerequisite to understand the role of fluids on seismicity. After a detailed (micro) structural analysis of deformation in both the compressive and transpressive domains, we analyzed veins and host rocks sampled along the main fault strands, using; 1) cathodoluminescence and optical microscopy, 2) X-ray diffraction, 3) carbon and oxygen stable isotopes analysis on calcite and quartz, 4) fluid inclusion microthermometry, 5) whole-rock geochemistry, and 6) Helium isotope analysis on fluids from natural springs along the faults.

Our first results show that; 1) towards the front of the Chaîne des Matheux, from north to south, $\delta^{13}C$ vein-host rock disequilibrium increases, with vein calcite displaying progressively more negative $\delta^{13}C$ values, 2) fluids expelled along the front of the Chaîne des Matheux have a helium Ra ratio signaling a strong mantle-derived component, 3) $\delta^{13}C$ vein-host rock disequilibrium is stronger for samples from the core of the EPGFZ compared to satellite faults, 4) helium Ra ratios for fluids sampled proximal to the EPGFZ display a less pronounced mantle-derived component. These results indicate that the faults at the front of the Matheux are deeply rooted and act as good conduits for the transport of fluids. The main fault branch of the EPGFZ is probably also deeply rooted but only intermittently acts as a good conduit for fluids, while conductivity along satellite faults is poor.