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Seismicity and magma intrusions at Yellowstone supervolcano: new insights

Elena Russo (1), Alessandro Tibaldi (1), Fabio Luca Bonali (1), Gregory P. Waite (2), Jamie Farrell (3), and Frederick Massin (3)

(1) Department of Geological Sciences, Milan-Bicocca, Milan, Italy (e.russo11@campus.unimib.it), (2) Department of Geological and Mining Engineering and Science, Michigan Technological University, Houghton, USA, (3) Department of Geology and Geophysics, University of Utah, Salt Lake City, Utah, USA

Yellowstone is considered one of the most active volcanic systems in the world due to the extensive geothermal system, intense seismicity, and episodes of surficial deformation documented over the past several decades that indicate the movement of magma in the upper crust. Despite this evidence for magma intrusion and a favorable extensional tectonic setting, no eruptions have occurred since 70ka.
Here we perform an accurate analysis of seismicity in terms of space-time evolution of fault kinematics, obtained by focal mechanism solutions (FMS), and related state of stress caused by sill intrusions between 1988 and 2016. We present a new and complete data set of 226 well-constrained, double-couple FMS, and we calculate Coulomb stress changes exerted on nodal planes and on mapped Quaternary faults by the sills in order to describe the deformation pattern prior to, during, and after these emplacements.
Our study suggests that sill intrusions produce unclamping of pre-existing fault planes in the upper part of the overburden, whereas the lower part is under compression. This might explain why magma upwelling along vertical planes has been inhibited even though the area is characterized by regional extension. We present structural models to explain the deformation pattern in different temporal windows in relation with sill emplacement, with the aim of providing new insights on why these intrusions stall instead of reaching the surface.