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Surface ruptures associated to the July-August 2007 Gelai volcano-tectonic event, North Tanzania

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A seismic crisis with a series of moderate earthquakes started on July 12^{th} 2007 in the Natron area in North Tanzania. According to the USGS-NEIC earthquake catalogue, it lasted up to the 8^{th} of September and 80 teleseismic earthquakes were recorded, with the strongest one on July 17^{th} (Mw 5.9). Soon after the main event of July 17^{th}, the presence of open surface fissures was reported on the ground, on the southern flank of the recent ($<$1 Ma) Gelai volcano, along the eastern side of the Natron rift depression.

Several couples of SAR images (ENVISAT satellite, descending orbit) were acquired and processed within the frame of the ongoing Saamav project. The interferogram encompassing July 17^{th} event shows the presence of two surface fracture systems delimiting a NNE-trending narrow graben in the southern flank of the Gelai volcano. These features were subsequently mapped in relative detail in the field in October 2007 before the following rain season. They turn to be subvertical open fissures, arranged in en-échelon way and displaying horizontal dilation as well as vertical offset. They are interpreted to evolve at depth into 60-75˚ dipping normal fault systems. According to their calculated dip, these fault systems converge at depth where they should either merge or intersect. Assuming a 50 m high vertical portion for the open fracture, the depth and horizontal coordinates of the fault intersection point are calculated for a series of profiles drawn across the graben structure.

It is suspected that the July-August moderate-magnitude earthquake swam crisis might

correspond to a volcano-tectonic event during which a magmatic dyke was injected at depth under the southern flank of the Gelai volcano. In this scenario, the observed graben structure bounded by the open fracture network and the inferred normal faults at depth are similar to the volcano-extensional structures that commonly form in the upper crust above a thin subvertical dyke injection. The top of this inferred dyke should correspond approximately to the intersection of the lines prolonging the two normal faults (even if physically the faults did not join the top of dyke), with an average depth of 4000m under the topographic surface.