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Insights into the crustal magmatic systems during rift evolution in Central Afar (Ethiopia)

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Magmatism plays a key role during continental break-up, from the initial broadly distributed stretching zones (i.e., continental rifting) to the formation of narrow zones of magmatic intrusion (i.e., spreading centers). The study of the crustal magmatic processes is crucial to unravel the conditions of the plumbing system, the magma ascent paths and therefore the relation between magmatism and rift evolution. The Afar depression is a classic example of a Rift-Rift-Rift triple junction where break-up processes are currently ongoing, making Afar a unique location where to study on-land evolution and propagation of a rift system at the continental-ocean transition. The widespread, flat lying, homogeneous, fissural basalts of the Stratoids Series flood basalts (4.5-1.1 Ma) spatially dominate the Afar depression. Then the Gulf Series basalts (1.1-0.6 Ma) and the Axial Series (< 0.6 Ma) have been emplaced, localized along the main grabens, and marking an important decrease in volume with respect to the Stratoids. Furthermore, several central silicic volcanoes (1.5-0.5 Ma) erupted effusive and pyroclastic products, acting as precursor of rift propagation. We present here new microanalytical data of fundamental and accessory minerals of magmatic products spanning from the Stratoid flood basalts to the localized activity of Central Afar in the Tendaho-Manda Hararo area. By means of textural and mineral chemistry characterization, geothermobarometry and geochemical modeling, we investigate the variations of the plumbing systems conditions and the ascending paths of these magmas during the Red Sea rift evolution in Afar. Preliminary results suggest a deeper magma storage level for the Stratoids flood basalts with respect to the subsequent localized activity. Furthermore, we compare our results with literature data to discuss the similarities between the Stratoids and other well studied flood basalts provinces.

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