

New carbonatite structure in the Adrar Souttoug massif: Evidence for a large metallogenic province

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Carbonatites and associated rocks stand out as the most prospective igneous complexes for an array of metals, including rare earth elements (REE) and Nb. The present work presents the mineralogical and geochemical characteristics of the newly discovered Terghat carbonatite structure in the peri-cratonic terrains of the Reguibat Shield (southern Morocco). This structure is characterized by a ~ 9 km ring-shaped outcrop consisting mainly of iron oxide rocks and vuggy siliceous breccias. The carbonatite outcrops consist mainly of fine-grained calcite carbonatite with significant apatite, variable Fe and Ti oxides and subordinate phlogopite. Carbocernaite and synchysite are present as the major REE-bearing phases, showing pseudomorphs after primary burbankite. The iron oxide rocks, forming thick regolith, have the highest concentration of REE and Nb in the form of monazite, REE-bearing Al-phosphates and residual pyrochlores. The pyrochlore chemistry depicts a primary magmatic to hydrothermal affinity within the silica breccia rocks to high A-site vacancy of late supergene origin within the iron oxide rocks, suggesting the effect of subsolidus processes in element distribution and enrichment. Besides, the silica breccia rocks are mineralized in the form of epigenetic monazite-rich veins and Sr-rich variety of pyrochlore. In essence, these critical minerals and their host lithofacies in the Terghat demonstrate a high degree of similarity to those of the neighbouring Cretaceous carbonatite structures of Twihinate, Lamlaga, and Lahjayra, as evidenced by comparable REE fractionation and multi-trace element variation. These observations suggest the presence of a potential genetic correlation with widespread alkaline metallogenic province in the northwestern part of the West African Craton.