REE MINERALISATION OF THE ZANDKOPSDRIFT CARBONATITE COMPLEX, SOUTH AFRICA.

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Carbonatite emplacement is one of the most challenging topics in the interpretation of modern and ancient igneous systems. The lack of suitable active analogues, the compressed timeframes and large potential volatile component/s expected during intrusion and eruption, as well as significant low temperature alteration and overprinting of multi varied means, have all conspired to make the emplacement of these rocks difficult to understand. Intense micro fracturing of intrusive carbonatite veins occurring at the Zandkopsdrift carbonatite complex obscure textural features and challenge mineral identification. The use of Qemscan (Quantitative Evaluation of Mineralogy using Scanning Electron Microscopy) analysis has allowed observations and conclusions to be drawn regarding the multistage nature of the intrusive veins. A number of primary minerals are identified to contain REE and together help define a detailed paragenetic history. Further, these minerals provide a source of the REE mineralisation contained within the main REE host mineral of the deposit which to date has been ascribed to weathering of apatite, release of REE, and reconstitution as monazite. The identification of primary carbonatite monazite, REE-bearing barite, multi-compositional Mn, Fe and Sr carbonate species, as well as presence of synchysite, indicates a more varied primary REE mineral composition and intrusive history. Characterisation of the carbonate species shows at least 5 varieties which belong to three main paragenetic events as described below:
(1) Ultra coarse monazite phenocrysts (inclusion free) + coarse Fe-Mg carbonate phenocrysts (inclusion free) + Ca carbonate calcite + pyrite (2) Intrusion of dolomite and complete disaggregation of existing veins. Reaction of existing Fe dolomite to ankerite (3) Intrusion of apatite and fracture filling, (4) Nucleation of primary, monazite in fracture intersections and strontianite.

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