Goldschmidt 2025 Abstract
https://doi.org/10.7185/gold2025.25733

# Genesis of ‘Panther skin-type’ calciocarbonatites from the Kamthai complex (India)

**DEWASHISH UPADHYAY**

Indian Institute of Technology Kharagpur

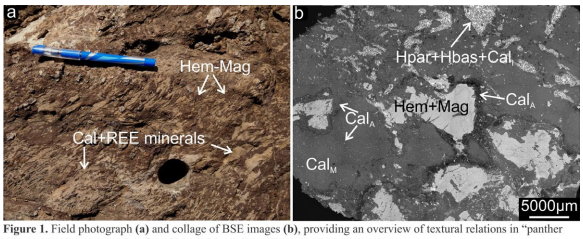



**Figure 1.** Field photograph **(a)** and collage of BSE images **(b)**, providing an overview of textural relations in “panther skin-type” calciocarbonatites from Kamthai (pen shown for scale is 15 cm long)

The Kamthai alkaline complex is a part of the Tertiary alkaline complex of Sarnu-Dandhali in western India. It comprises melanephelinite, ijolite, alkali basalt, nepheline syenite, phonolite, and carbonatite. The Kamthai complex hosts unique calciocarbonatites, which have been referred to as “panther-skin-type” by Bhushan [1]. These are characterized by discontinuous, often anastomosing dark brown globular patches/layers within leucocratic carbonatite. The dark brown layers/patches are of Fe-oxides (15-20 modal %) together with minor ilmenite, which occur as blebs or discontinuous layers in a groundmass of carbonates. The lighter patches comprise calcite and/or calcite intergrown with REE-minerals (Fig. 1).

The microtextures comprise intergrowth of bastnäsite, hydroxyl-parisite, röntgenite, synchysite, and pyrochlore, with calcite that pseudomorphs hematite patches having cellular boxwork-type structure and containing relict magnetite. The carbonatites have undergone extensive low-temperature hydrothermal alteration as seen from microtextural relations and trace element chemistry of hematite, magnetite and calcite, and C-O isotope composition of carbonate [2]. The squarish outlines of the hematite boxwork structure and the REE minerals-calcite intergrowths, and the presence of relict magnetite in them, suggests that they have pseudomorphed primary magnetite during fluid-rock interaction.

The microtextures can be explained by influx of acidic hydrothermal fluids, which caused protonation of magnetite and leaching out of $Fe^{2+}$, converting them to boxwork-type hematite through a non-redox transformation. This resulted in 32% volume reduction for every mole of magnetite consumed and generated significant rock porosity, which further aided and abetted fluid-rock reaction and hydrothermal alteration. The acidic fluid scavenged the REE and other trace elements from magmatic carbonates and apatite. The magnetite to hematite transformation consumed protons, which neutralized the hydrothermal fluid as the fluid-magnetite interaction progressed. Increase of pH in the reaction zone triggered the precipitation of bastnäsite, parasite, röntgenite, synchysite, and hydrothermal pyrochlore. The pseudomorphic nature of the replacement resulted in the hematite and REE minerals intergrowth taking the shape of the original magnetite patches.

**References**

[1] Bhushan (2015). Journal of the Geological Society of India 85, 537–546.

[2] Upadhyay et al. (2021). Lithos 400-401, 106381.