Goldschmidt 2025 Abstract
https://doi.org/10.7185/gold2025.25479

Application of fractal and lacunarity analyses to evaluate granophyric aplites: tracing high silica magma genesis and post-emplacement prosseses in the Mikir Massif, Northeast India

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The presence of aplitic-pegmatitic bodies is fairly evident in the Assam-Meghalaya Gneissic Complex (AMGC), Northeast India. These high silica intrusions are thought to stem from magmatic events associated with the Pan-African post-collisional magmatic activities. The Shillong Group, belonging to the Mikir Massif in the AMGC, host numerous crosscutting aplitic dikes. The magmatic activities attributed to the Pan-African event in the AMGC are predominantly represented by granitic compositions. These felsic bodies are two-feldspar subsolvus granites, and such granitic magmas with high water content are deemed responsible for generating aplitic and pegmatitic dikes. The aplitic dikes in the study area are characterised by two main textural units: (i) fine-grained granophyric aplite and (ii) relatively coarser aplitic unit with quartz, alkali feldspar, biotite, muscovite, and coarser granophyric texture. Mineral chemical and geochemical analyses were carried out to ascertain the nature and evolution of the aplites. We also utilised fractal and lacunarity calculations to quantify and analyse the two granophyric variants from the aplitic dikes and comment on their textural heterogeneity. The correlation between the values of fractal dimension (D_B) and lacunarity (Λ) indicates shift from equilibrium due to different degrees of undercooling. Evaluating the relationships between the results of fractal and lacunarity calculations, we demonstrate how different degrees of undercooling influenced the textural variation in the aplitic dikes post emplacement. Notably, the granophyric texture along the margin of the aplitic dikes exhibit higher D_B, low Λ, and a greater negative slope, while those inward are characterised by lower D_B, high Λ, and a smaller negative gradient, signifying the changing undercooling conditions. This study addresses the generation of aplitic magmas in the Mikir Massif and provides an intricate comprehension about their evolution following emplacement.