Dufrénite crystallization in an Archaean BIF from the Mahadevi Layered Complex, Tamil Nadu, India

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Hydrated Fe-phosphates from gossan zones of iron ore deposits and greisenized zones of phosphate rich pegmatites had been documented from different parts of the world but hitherto not reported from any Indian rocks.

The Archaean Mahadevi Layered Complex (MLC) which is a part of the Granulite Terrane of Southern India (GTSI), exposes lithounits of Banded Iron Formation (BIF) in association with the mafic rocks. The entire litho ensemble has underwent high pressure metamorphism and deformation at c.2.5 Ga. Besides quartz and magnetite, the metamorphosed BIF contains ortho- and clino-pyroxene with a few percent of apatite. In the altered part of BIF, hydrated iron phosphates replace apatite grains along margins and also form reticulate network along fractures. Chemical composition of the phosphates varies gradationally from calcium rich to iron rich phosphate (dufrénite group of mineral) with little Si in the composition. The CaO varies from 54.11%-12.19%-0.32% with concomitant rise in FeO_{total} from 0.14%-12.38%-54.65% across apatite-mixed zone-dufrénite contact indicating an intense aquous fluid–rock interaction during chemical weathering of the BIF. Textural modelling with C-space identifies the following reaction that explains the composition and textural features of the dufrénite:

500.00**apatite** + 232.63**magnetite** + 145.00**quartz** + 3489.38 H_2O + 2843.84Fe^{3+} + 662.90Fe^{2+} + 7.19Mg^{2+} + 111.7111Na^{+} = 348.94**dufrénite** + 1725.12O_2 + 1.00Mn^{2+} + 4933.10Ca^{2+}.