Mineralogy of Jamdoba-XI lamproite dyke from Jharia basin, Jharkhand, India

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INTRODUCTION

- Diverse mantle-derived volatile enriched alkaline igneous rocks include Lamproites, Kimberlites, Orangeites and Lamprophyres.
- Hybrid rocks with complex mineralogy and entrain crustal as well as mantle xenoliths and xenocrysts.
- Important rocks to study the sub-continental lithospheric mantle.
- Economically important as kimberlites and lamproites are potentially diamond-bearing.

OBJECTIVES

- To study the mineralogy of a K-rich dyke, Jamadoba-XI and their nomenclature by identification of typomorphic minerals.
- To establish their affinity to lamproites or aillikites.
- To study the magmatic crystallisation history of these dykes through compositional trends shown by zoned phases.

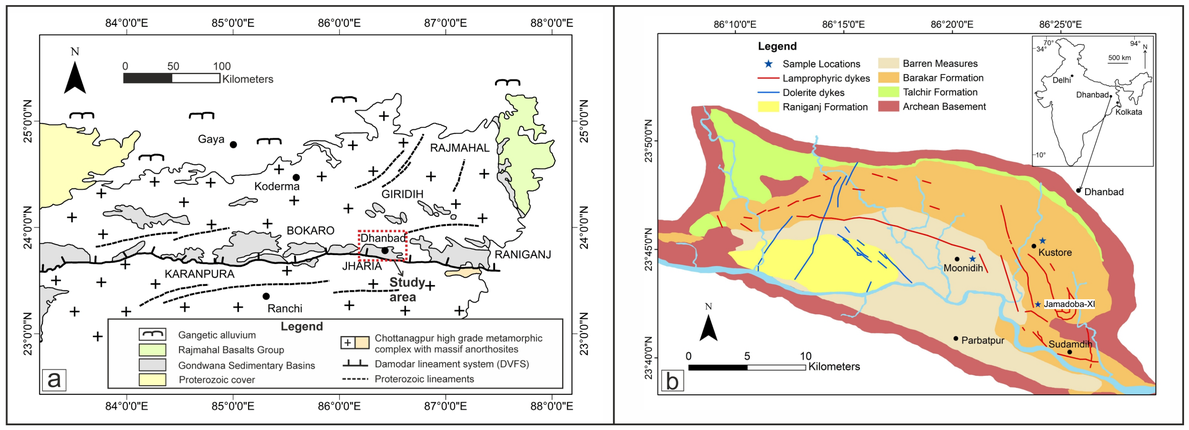

Figure 1. (a) Gondwana coalfields in the Damodar Valley (after Mitchell and Fareeduddin 2009); **(b)** Geological map of Jharia basin (modified after Srivastava et al. 2009).

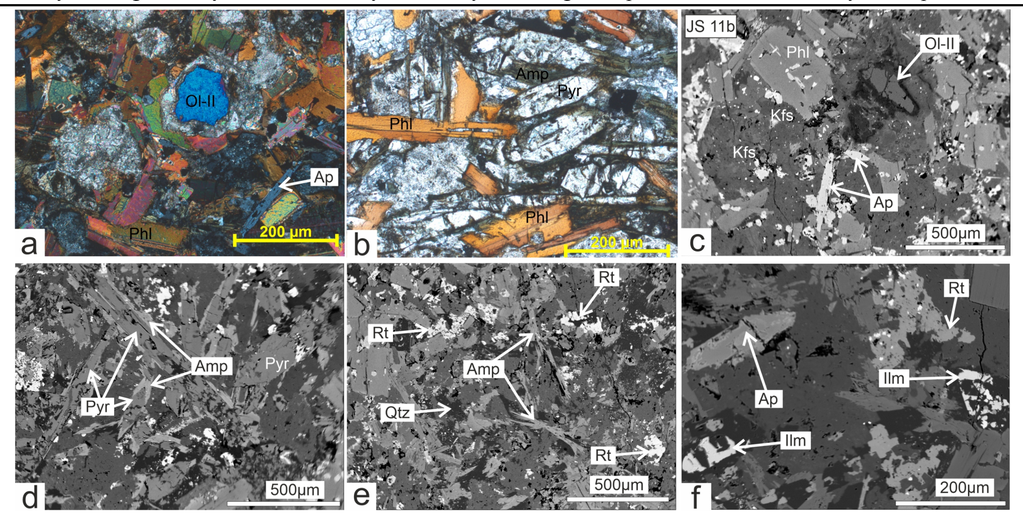

Figure 2. Photomicrographs (a, b) and BSE images (c-f) of Jamadoba-XI dyke illustrating the presence of olivine-II, phlogopite, pyroxene (diopside), and apatite in groundmass of phlogopite, pyroxene, amphibole, apatite, ilmenite, rutile and K-feldspar. (a. XPL; b. PPL)

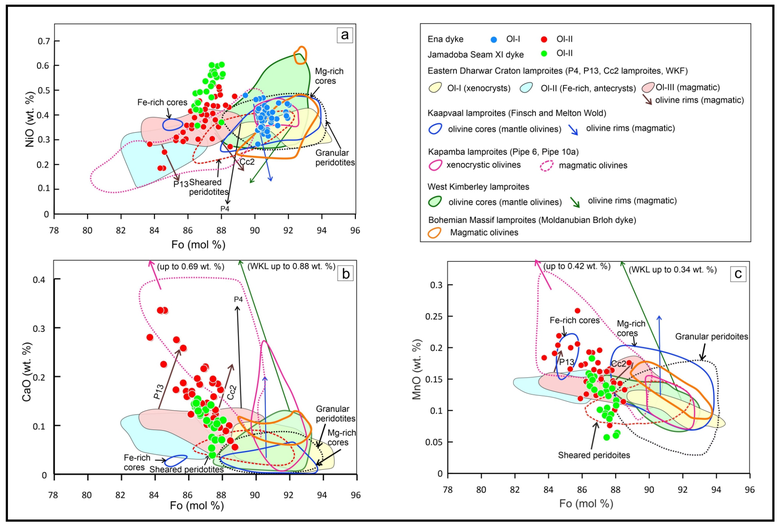

Figure 3. Mg# vs. NiO, CaO, MnO plots for olivine-II in Jamadoba-XI dyke. Also shown the Olivine-I and II from Ena lamproite of Jharia basin (Kaur et al. 2023)

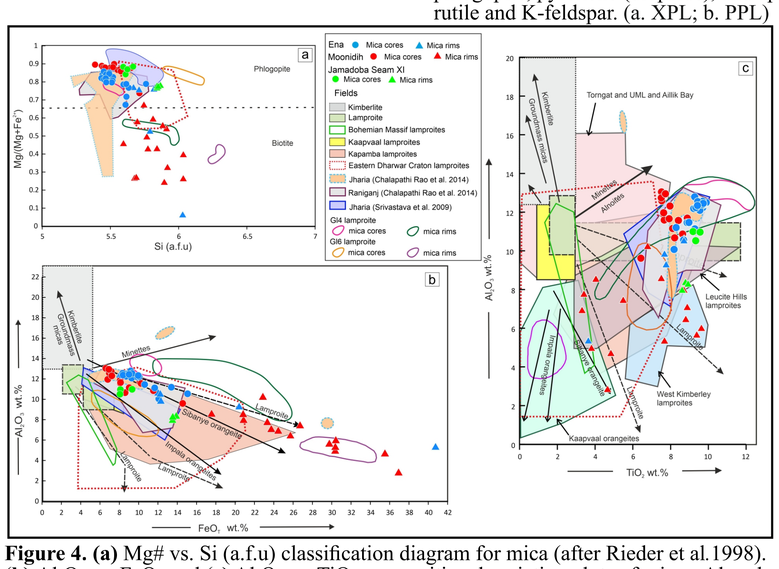

Figure 4. (a) Mg# vs. Si (a.f.u) classification diagram for mica (after Rieder et al.1998). **(b)** Al_2O_3 vs. FeO_T and **(c)** Al_2O_3 vs. TiO_2 compositional variation plots of micas. Also shown the phlogopite-biotite from Ena and Moonidih lamproites of Jharia basin (Kaur et al. 2023)

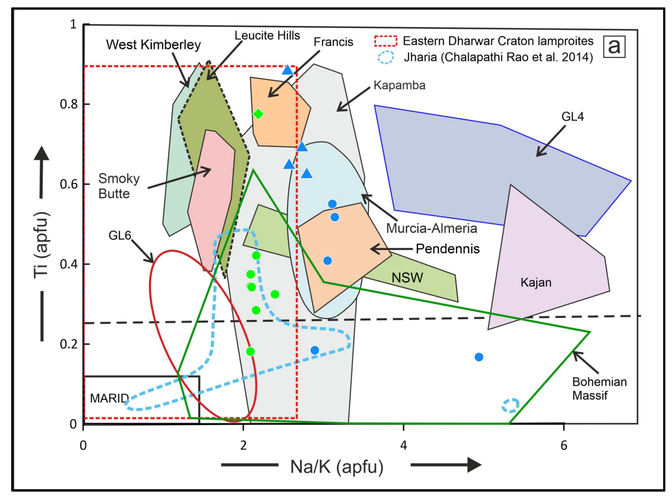

Figure 5. Ti vs. Na/K (apfu) compositional variation plot of Jamadoba-XI amphiboles. Also shown the amphiboles from Ena lamproite of Jharia basin (Kaur et al. 2023)

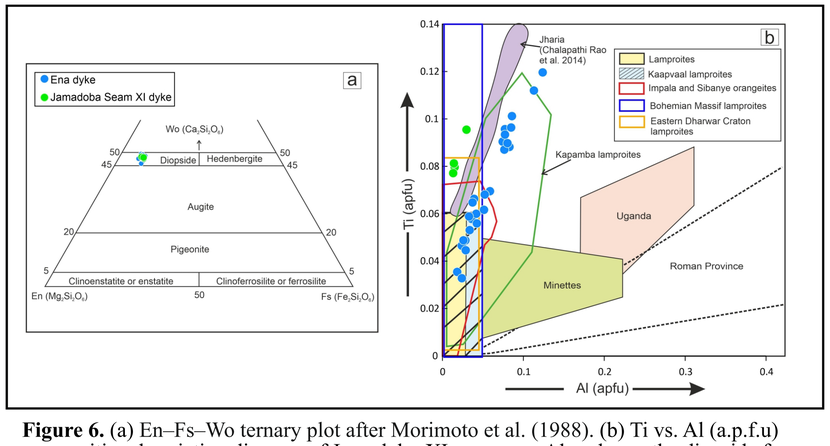

Figure 6. (a) En–Fs–Wo ternary plot after Morimoto et al. (1988). (b) Ti vs. Al (a.p.f.u) compositional variation diagram of Jamadoba-XI pyroxene. Also shown the diopside from Ena lamproite of Jharia basin (Kaur et al. 2023)

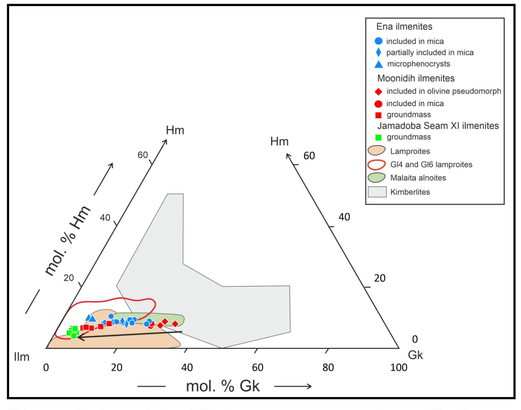

Figure 7. Jamadoba-XI ilmenites projected on a Fe_2O_3–$FeTiO_3$–$MgTiO_3$ ternary diagram. Also shown the ilmenites from Ena and Moonidih lamproites of Jharia basin (Kaur et al. 2023)

DISCUSSION AND CONCLUSIONS

- Using a mineralogical-genetic classification scheme,

Jamadoba-XI dyke: olivine-phlogopite-apatite-diopside-sanidine lamproite (*var. Damodar*).

1. Olivine-II: forsteritic olivine, Magmatic.
2. Phlogopite: low Al and Fe rich phlogopite
   Al depletion and Fe enrichment from cores to rims.
3. Clinopyroxene: Al-Na poor diopside.
4. Amphibole: Al-poor and Ti-rich and show evolution from eckermannite-arfvedsonite
5. Fluorapatite: Ba, Sr and LREE enrichment from cores to rims.
6. K-feldspar: Fe-rich (1.4-4.9 wt. % Fe_2O_3) sanidine.

- It is not similar to aillikites (>14 wt. % Al_2O_3 in mica; high Al and Ti clinopyroxene and <0.85 Cr/(Cr+Al) in spinels).
- Originated by the partial melting of hydrous mineral bearing veins as part of ancient metasomatized lithospheric mantle lithosphere.

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