TEXTURAL AND COMPOSITIONAL VARIATION OF CARBONATE MINERALS IN THE NEWANIA CARBONATITES, RAJASTHAN, INDIA

Amritpaul Singh
Department of Geology, Panjab University, Chandigarh-160014, India
email id: apsbhatti05@gmail.com

Introduction

- Carbonatite are igneous rock which comprises of more than 50 vol. % primary carbonate minerals and have less than 20 wt. % silica content (Le Maitre 2002).
- Mitchell (2005) has defined carbonatite as an igneous rock which contains more than 30 vol. % magmatic carbonate phases, irrespective of silica content.
- Globally, there are more than 500 carbonatite occurrences, found largely in continental settings and range in age from Archean to Recent (Jones et al. 2013; Woolley and Kjarsgaard 2008).
- These are undoubtedly mantle derived rocks, formed via fractional crystallization and/or liquid immiscibility from a carbonated alkaline silicate melt or direct partial melting of a carbonate-bearing mantle source (Jones et al. 2013 and references cited therein).
- Not only carbonatites but its associated rocks are known to host many important ore deposits of metallic and industrial minerals (Simandl and Paradis 2018).
- Indian Peninsula is home to more than 26 carbonatites (Krishnamurthy 2019), among which The Newania carbonatite complex (~1.4; Ray et al. 2013) is one of the oldest and only dolomite-dominated occurrence.

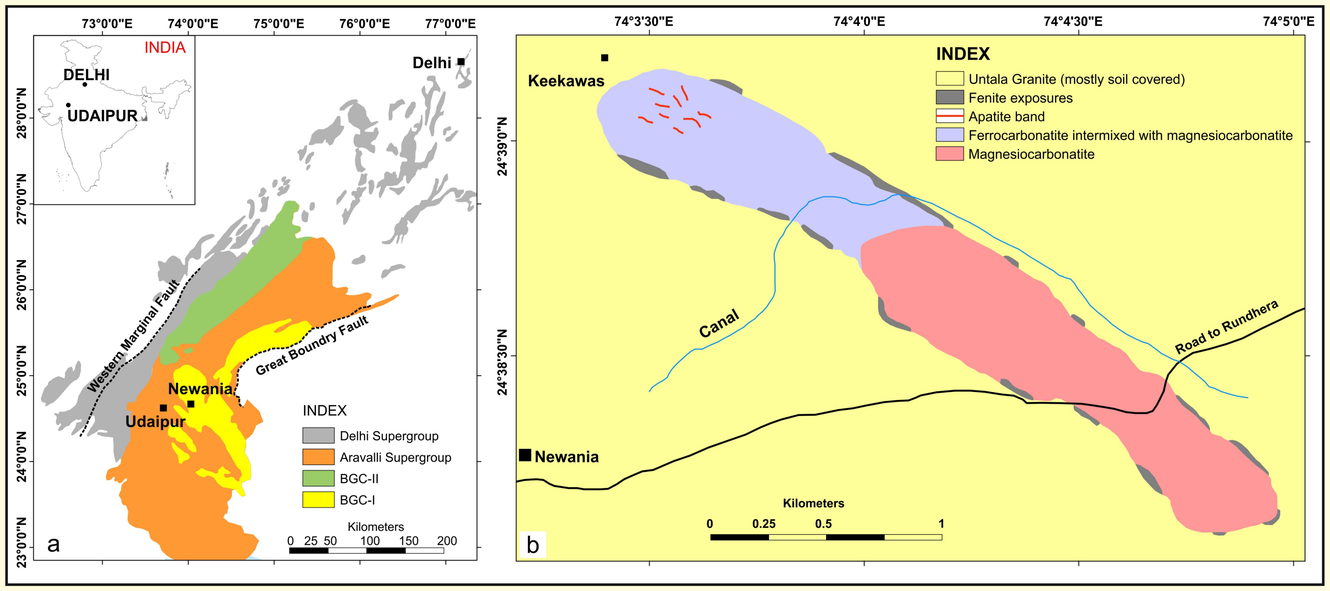

Figure 1. (a) Regional geological setting of Aravalli craton (after Heron 1953; Roy and Jakhar 2002); (b) Geological setting of Newania carbonatite complex (after Tantkar 2019).

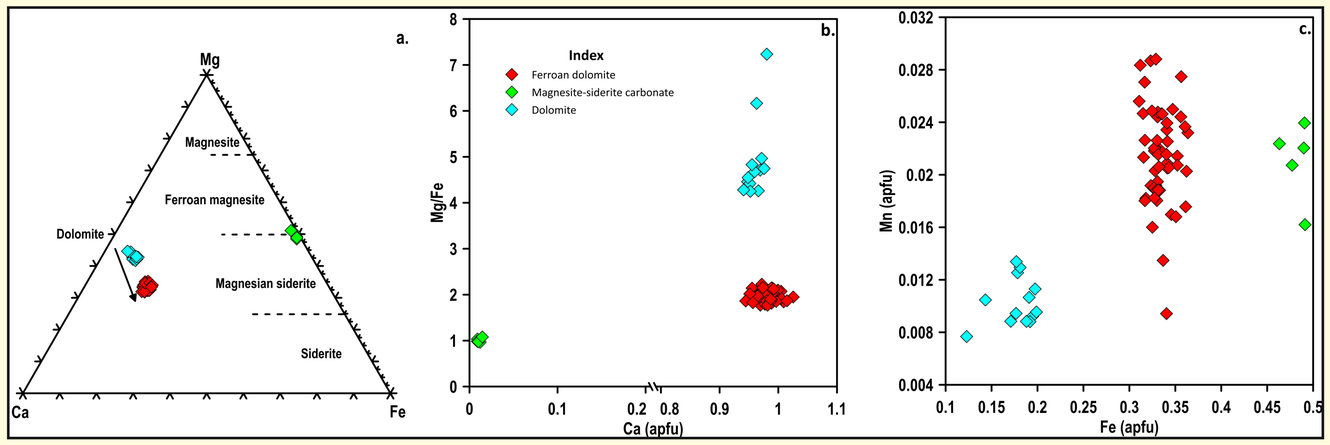

Figure 3. Compositional variation plot for carbonates in Newania carbonatites. (a) Fe-Mg-Ca ternary plot (apfu; after Mitchell and Gittens 2022); (b) Mg/Fe versus Ca (apfu); (c) Mn versus Fe (apfu).

Discussion

- Carbonatites can readily undergo textural re-equilibration at low P and T. Similar is in case of the Newania carbonatite complex which is present in a metamorphic terrain.
- The magnesiocarbonatite have undergone different degrees of deformation which progressively increases towards south-eastern region.
- Carbonate textures resembles that of low-to-high strain-to-dynamic recrystallization textures.
- The EPMA compositions of dolomite-ferroan dolomite are similar to those in carbonatites, worldwide (Boukirou et al. 2022; Chakhmouradian et al. 2016; Doroshkevich et al. 2007).
- An increase in Fe and Mn with compositionsl evolution from dolomite-to-ferroan dolomite indicates magmatic origin and negligible influence of deformation/metamorphism on mineral compositions.

Objective of this study

- Mineralogical studies of the carbonate phases present in magnesiocarbonatite of the complex to understand the effects of post-emplacement deformation/metamorphic processes.

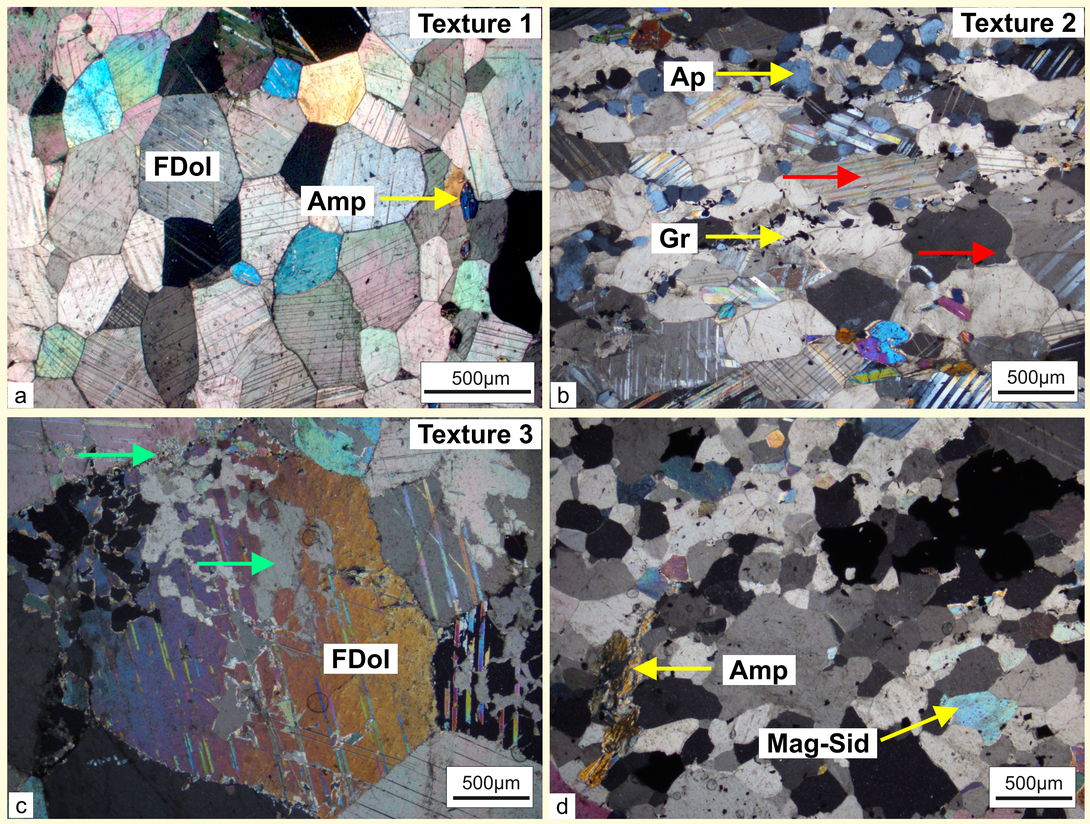

Figure 2.Photomicrographs of the magnesiocarbonatite displaying (a) arrangement of ferroan dolomite in mosiac fabric; triple junctions are evident; (b) orientation of elongated ferroan dolomite crystals in one direction, having high aspect ratio and triple junctions; apatite display undulose extinction (c) coarse, recrystallized ferroan dolomite carbonate with fine-grained carbonates at crystal boundaries and penetrating the coarse crystal; (d) textural relationship between ferroan dolomite and magnesite-siderite carbonate. (Abbreviations: Amp Amphibole, Ap apatite, Fdol ferroan dolomite, Gr graphite, Mag-Sid magnesite-siderite carbonate.

Table 1. Representative EPMA compositions of carbonates in magnesiocarbonatite

Oxide, wt. %	Dolomite		Ferroan dolomite					Magnesite-siderite	
FeO	4.64	6.96	12.51	12.76	12.05	11.07	11.50	35.78	35.81
MnO	0.29	0.32	0.73	0.61	0.33	0.93	0.72	1.63	1.48
MgO	18.85	17.75	12.98	12.67	12.62	13.40	13.02	20.04	20.34
CaO	28.92	27.41	27.05	27.07	28.04	26.58	25.10	0.61	0.65
Total	52.70	52.44	53.28	53.12	53.04	51.98	50.35	58.06	58.28
Structural formula calulated on the basis of 2 cations for dolomite-ferroan dolomite; 1 cation for magnesite-siderite									
Fe	0.123	0.188	0.352	0.361	0.340	0.317	0.340	0.484	0.481
Mn	0.008	0.009	0.021	0.018	0.009	0.027	0.022	0.022	0.020
Mg	0.889	0.855	0.651	0.639	0.635	0.683	0.687	0.483	0.487
Ca	0.980	0.949	0.976	0.982	1.015	0.974	0.951	0.011	0.011
Total	2	2	2	2	2	2	2	1	1

Conclusions

- Textural investigations of rock-forming carbonate phases in magnesiocarbonatite display effects of post-magmatic deformation/metamorphism.
- Texture (1) of carbonates represents low strain texture; texture (2) and (3) represents deformational changes as a result of high-strain and low-T conditions to high-T dynamic recrystallization, respectively.
- Compositional evolution from dolomite-to-ferroan dolomite represents magma evolution.
- Textural details and compositions of magnesite-siderite carbonates attest for magmatic origin and indicate origin of parent magma for Newania carbonatites at pressures exceeding 30 kBar via. very low partial melting of magnesite-phlogopite-bearing peridotite.

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