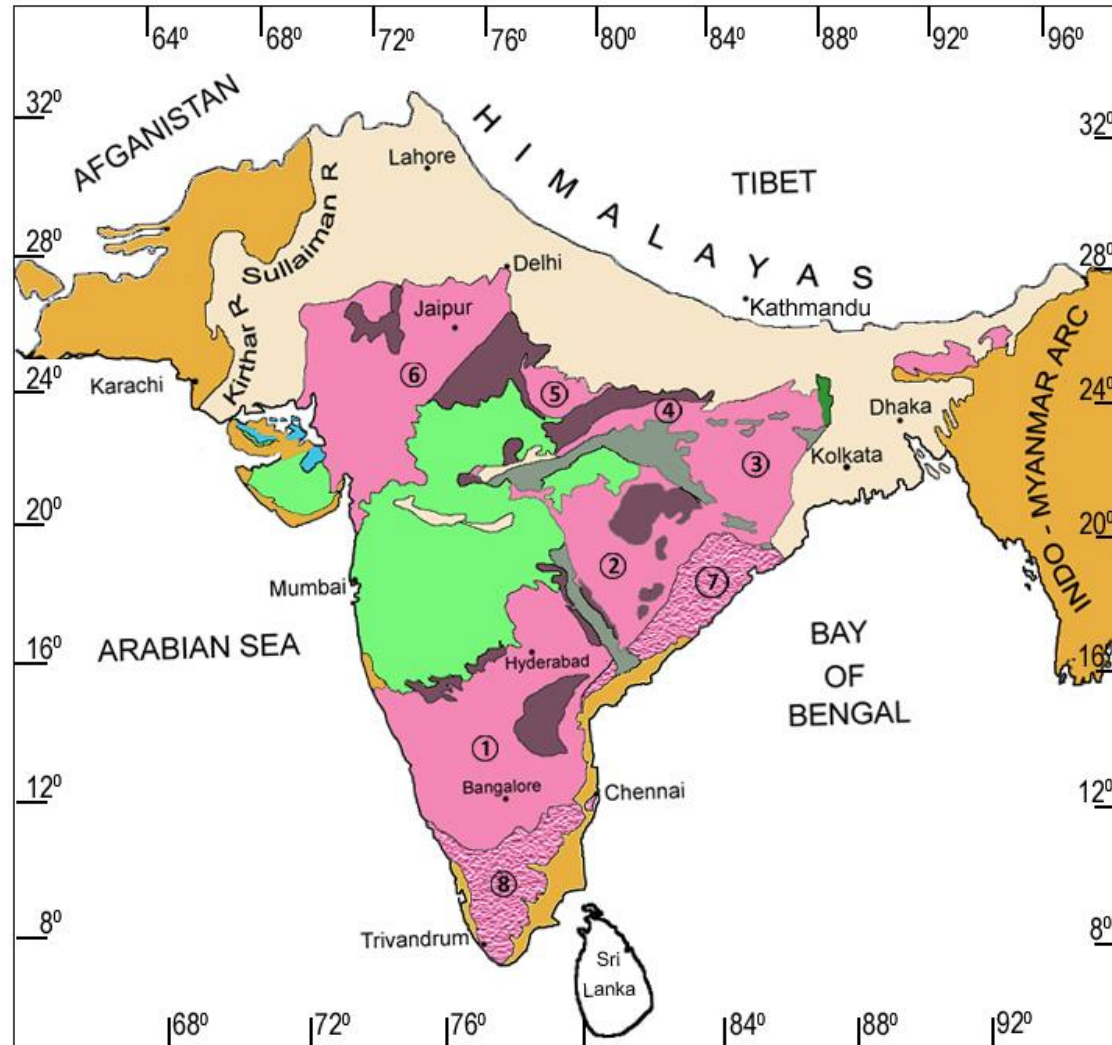


Aravalli Supergroup

Presentation by
Dr. Ritesh Purohit

Precambrian rocks of the Indian Shield is made of several Protocontinents and accreted terranes

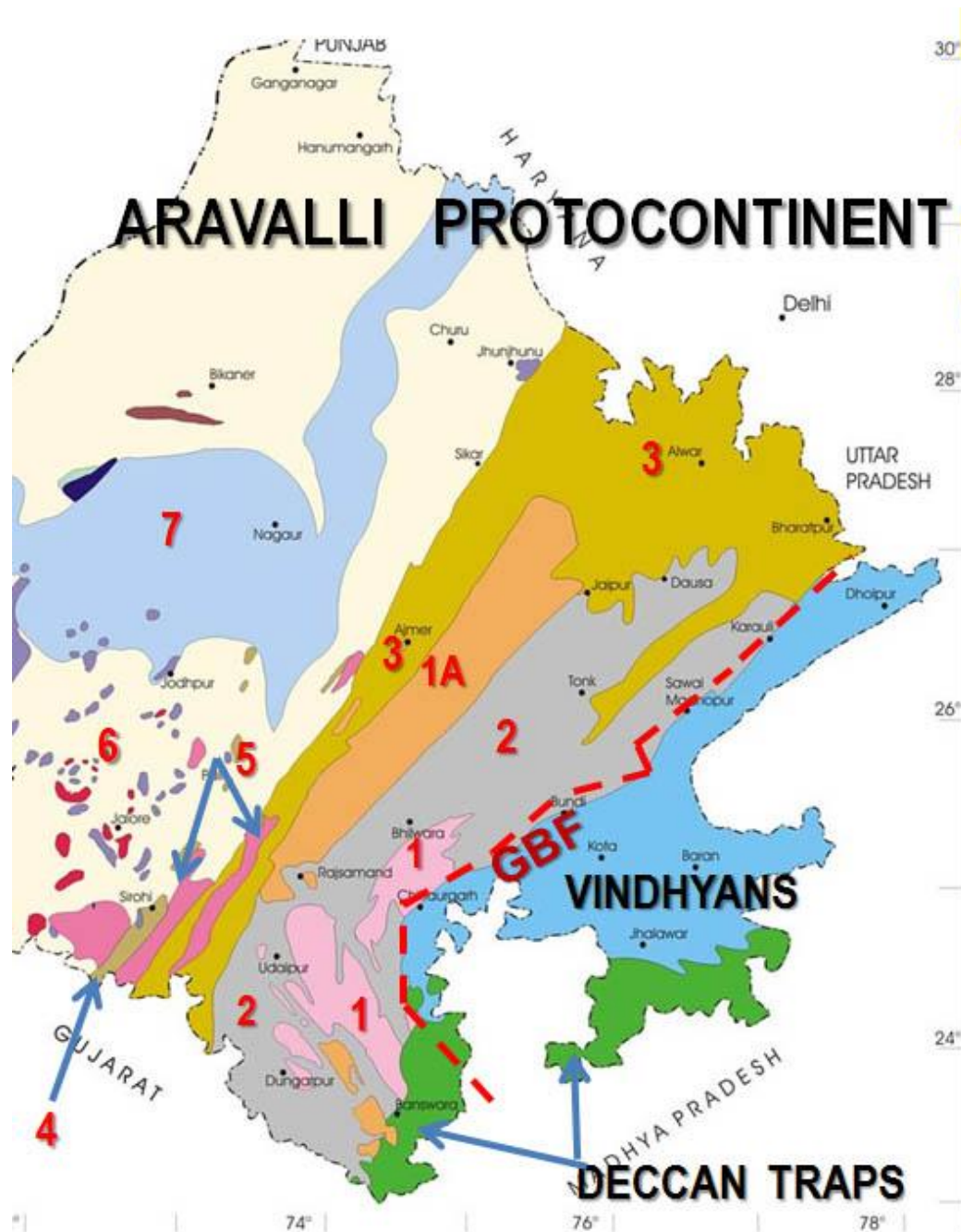


Protocontinents

1. Dharwar
2. Bastar
3. Singhbhum
4. Rajmahal
5. Bundelkhand
6. Aravalli

Accreted terranes

7. Eastern Ghats
Granulite Belt
8. Southern
Granulite Belt

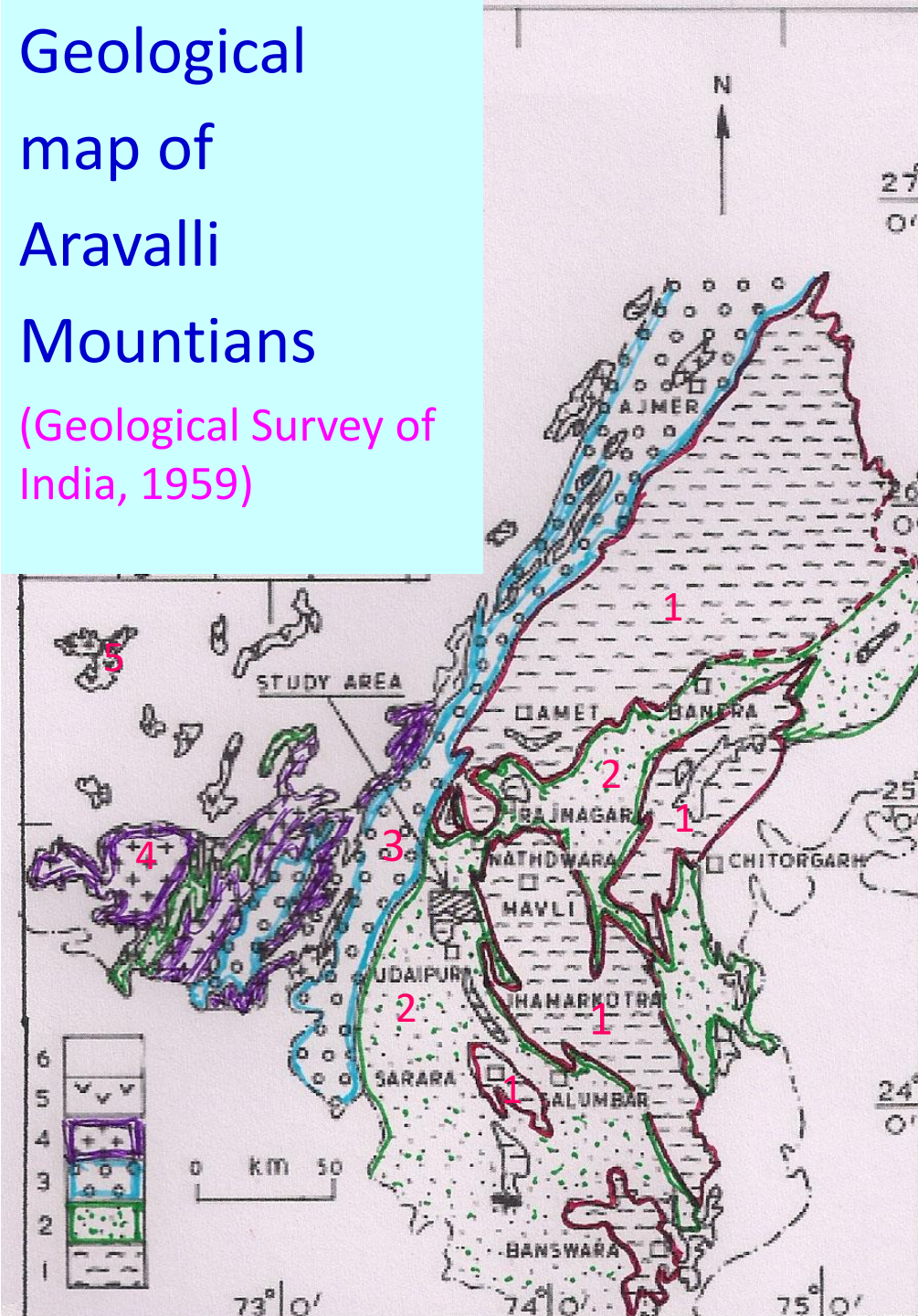


Aravalli Protocontinent
constitutes of -

7. Marwar Supergroup
6. Malani Group
5. Erinpura Granite
4. Sirohi Group
3. Delhi Supergroup
2. Aravalli Supergroup
- 1, 1A Archaean Basement
(partially reconstituted)

Geological map of Aravalli Mountains

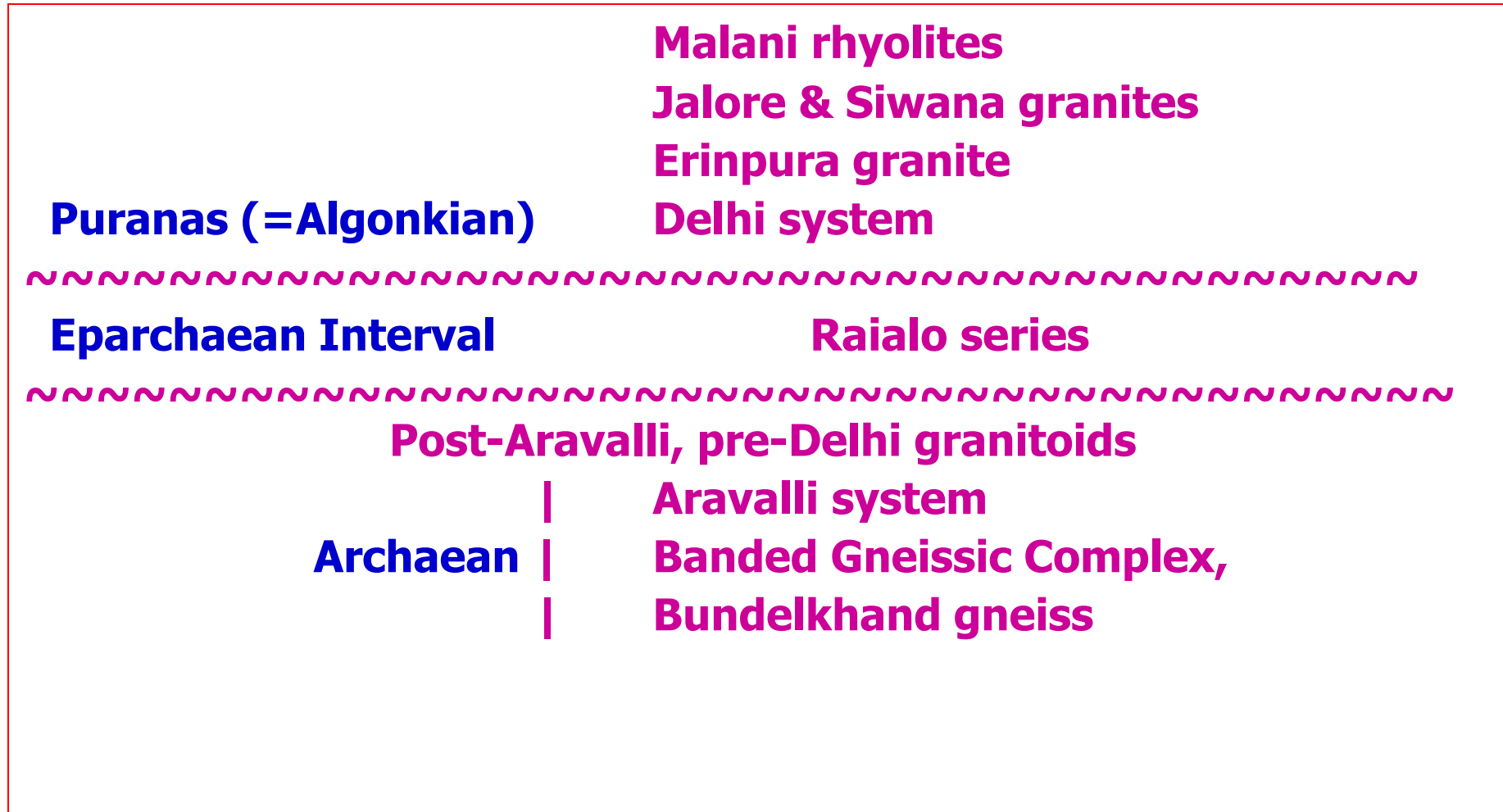
(Geological Survey of India, 1959)

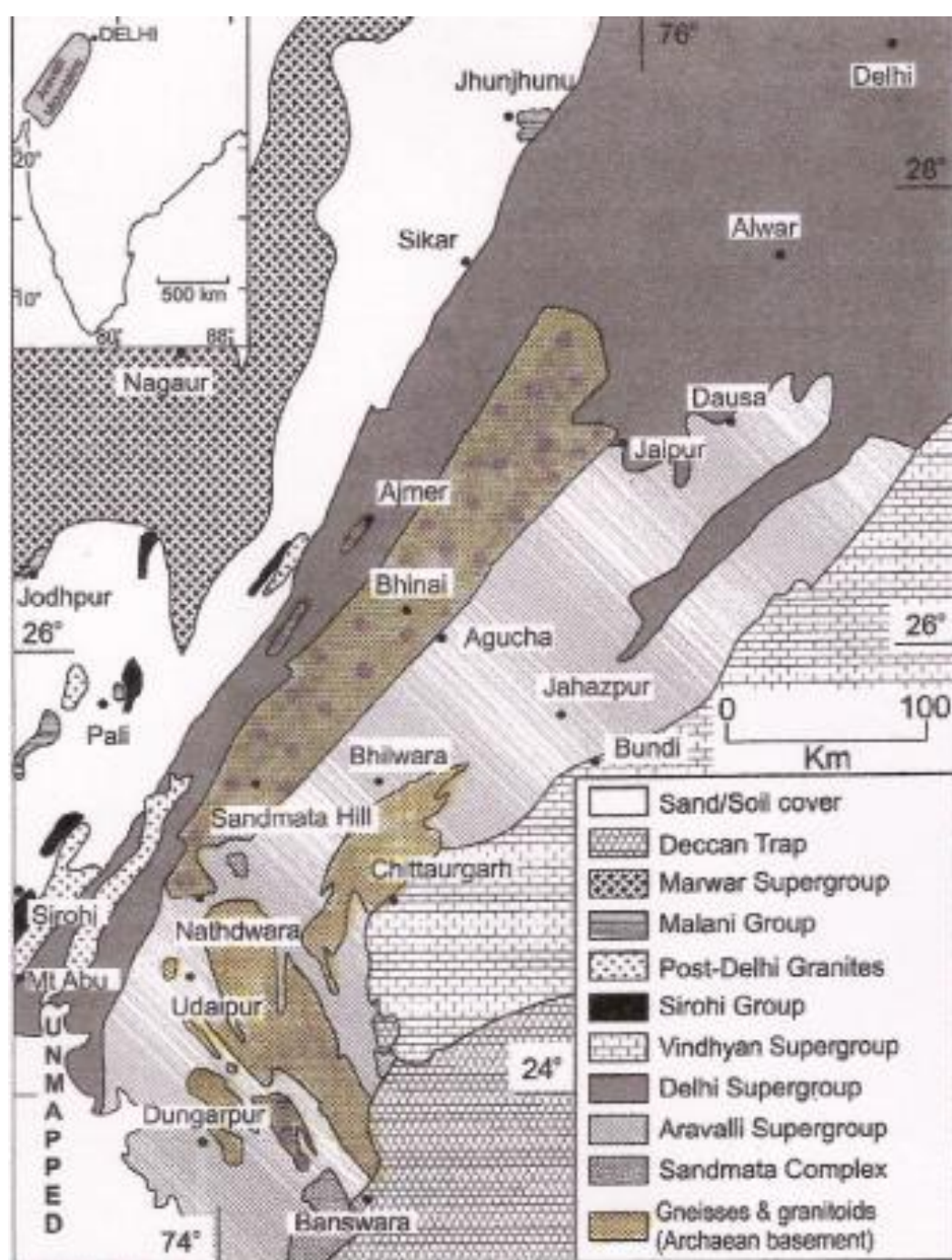


Heron & colleagues recognised following stratigraphic formations:

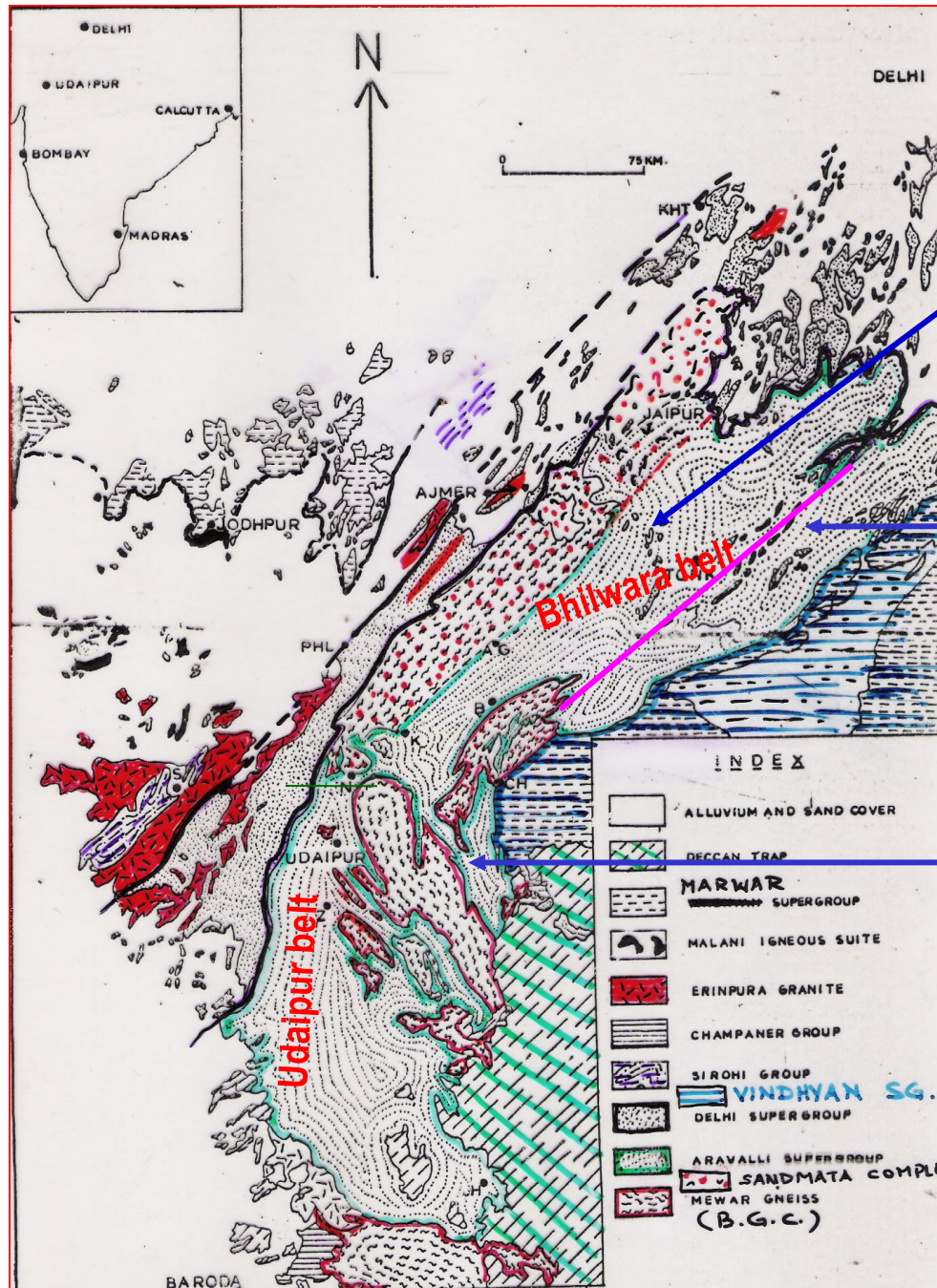
6. Post Malani rocks & sand-soil cover
5. Malani rhyolites
4. Erinpura granite
3. Delhi system
2. Aravalli system
1. Banded Gneissic Complex, Bundelkhand granite

Stratigraphic succession of the Aravalli Mountains according to AM Heron & colleagues



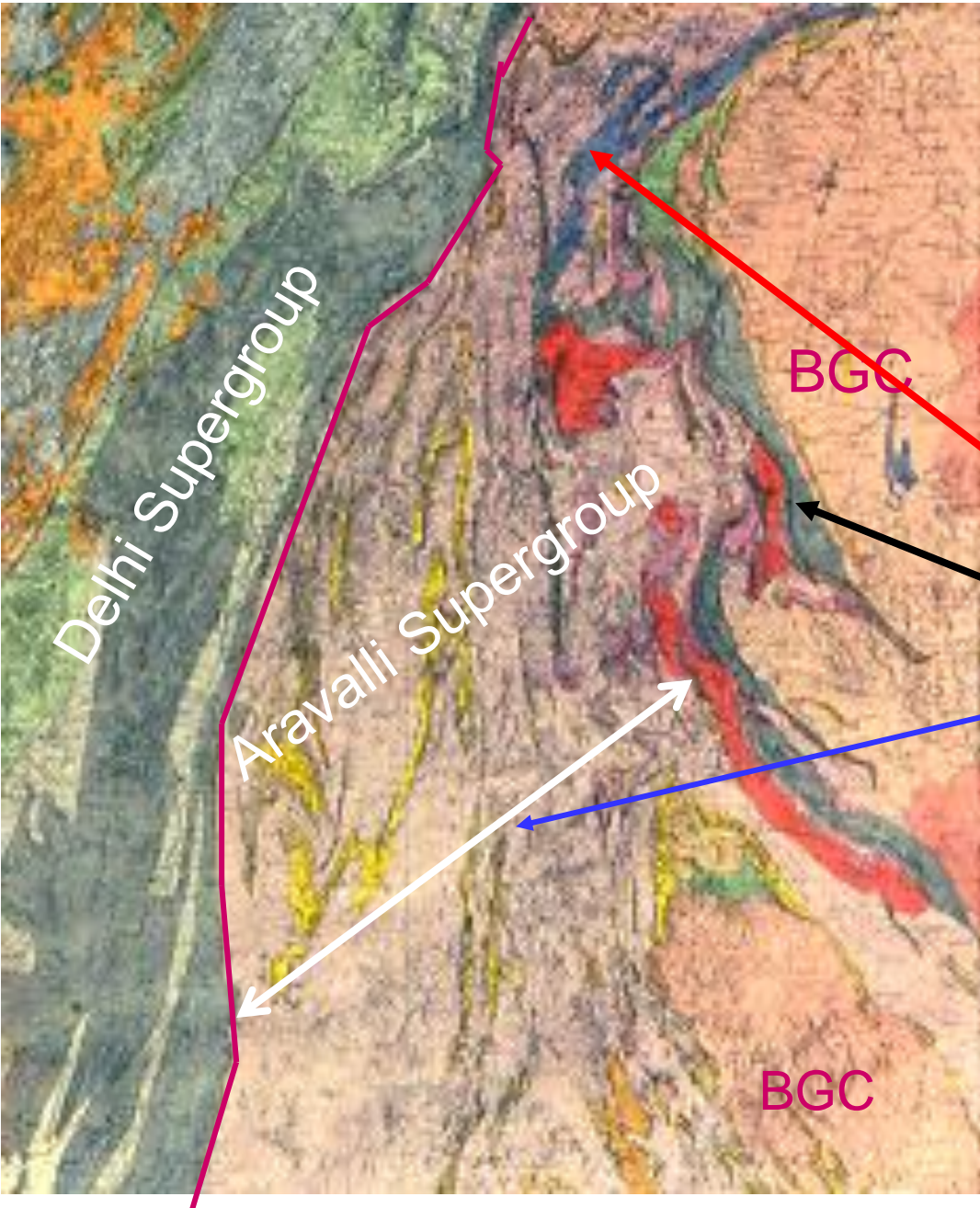


Distribution of the Aravalli Supergroup

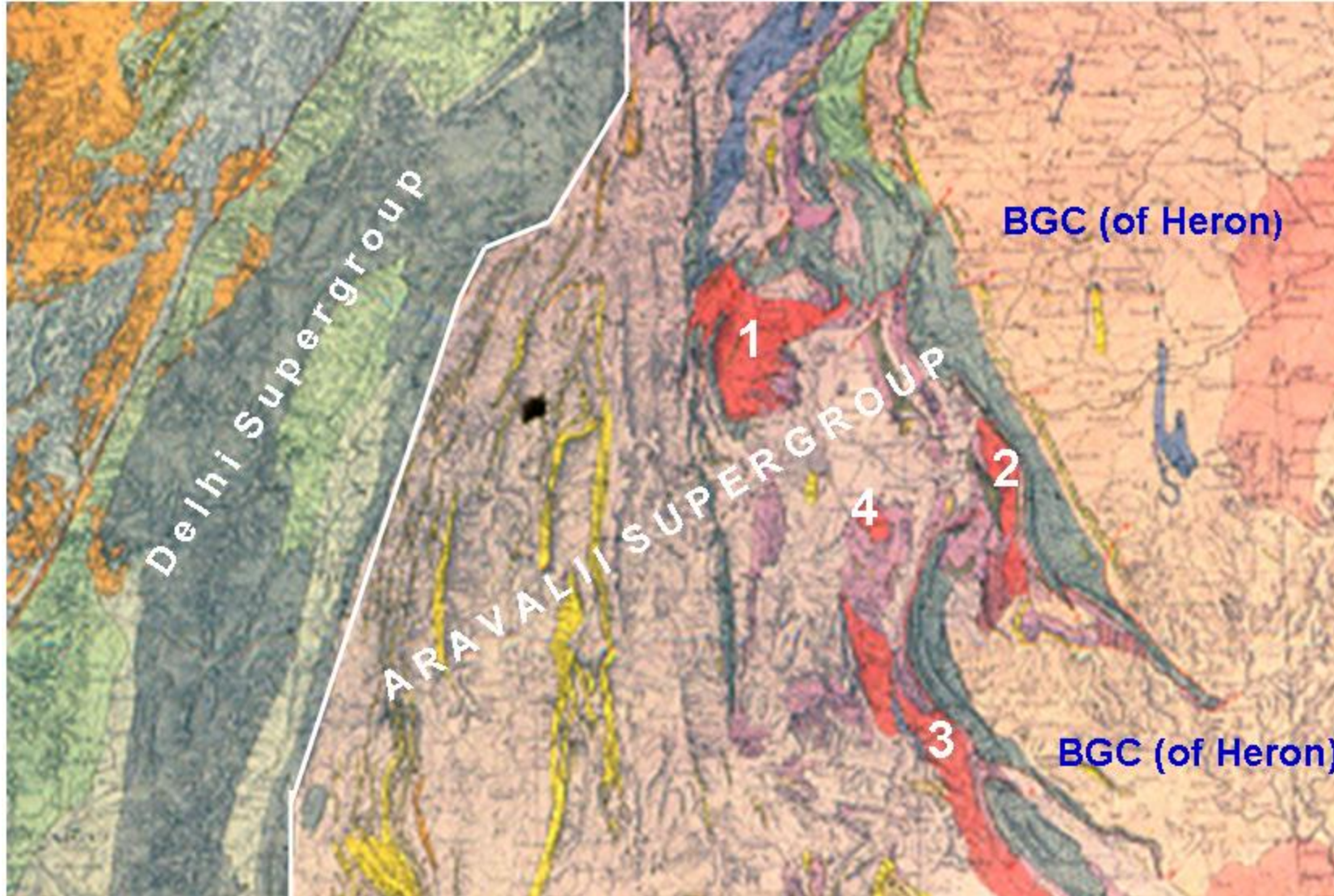


High grade metamorphic belt

Low grade metamorphic belt



Detailed mapping in key areas around Udaipur indicated that all metasedimentary-meta-volcanic formations, like Raialo series, Outliers of Delhi system, & Aravalli system (of Heron) constituted a single continuous succession, described as Aravalli Supergroup



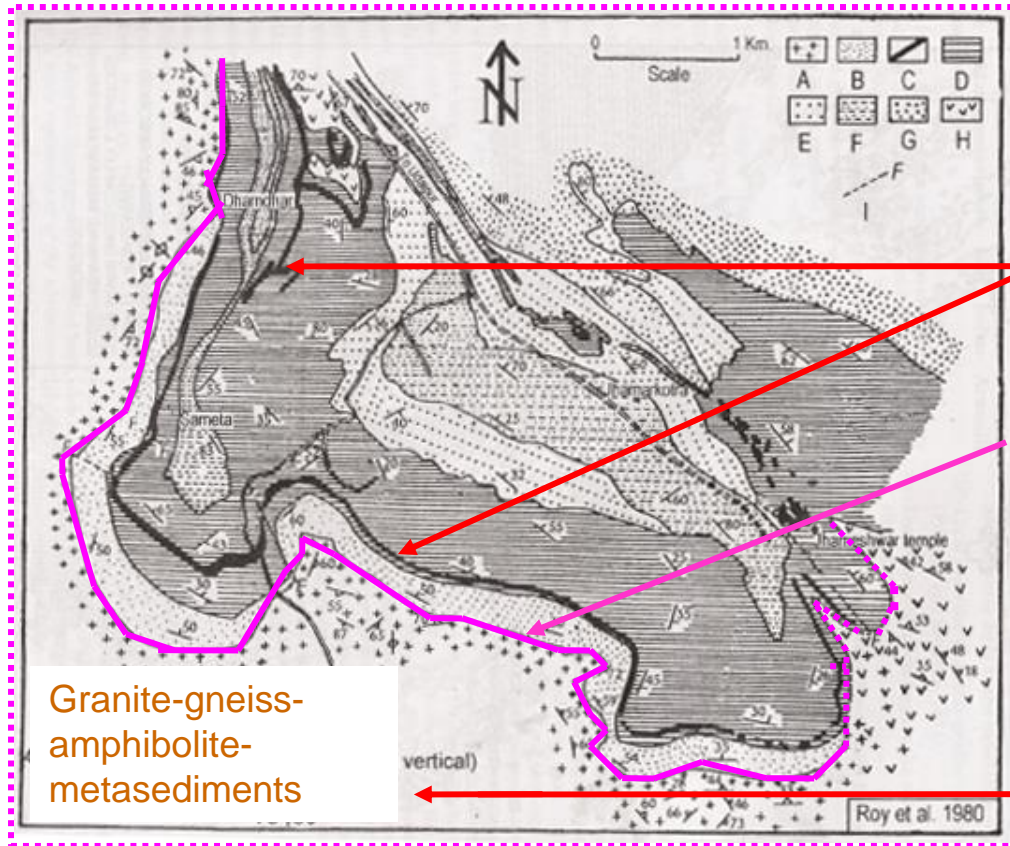
Heron recognised four granite-gneiss masses around Udaipur as 'intrusive bodies' within the Aravalli 'system'. These are:

1. Ahar River granite;
2. Udaisagar granite;
3. Jaisamand Road granite; and
4. Titardi granite



Recent studies based on isotopic dating and precise mapping revealed that the so-called 'Post-Aravalli intrusive granites' (red coloured outcrops) constituted Archaean gneiss-granite ensemble.

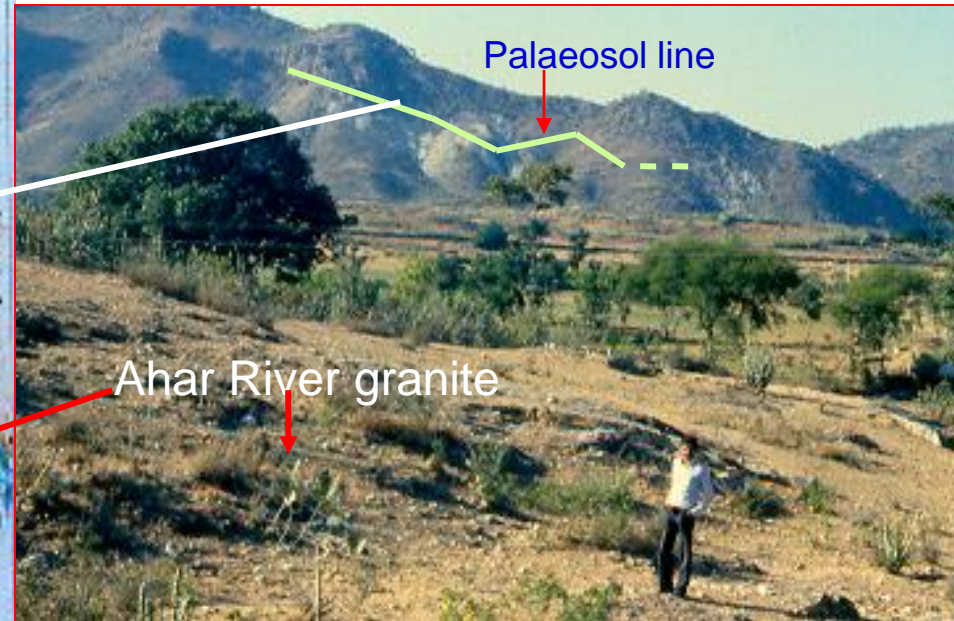
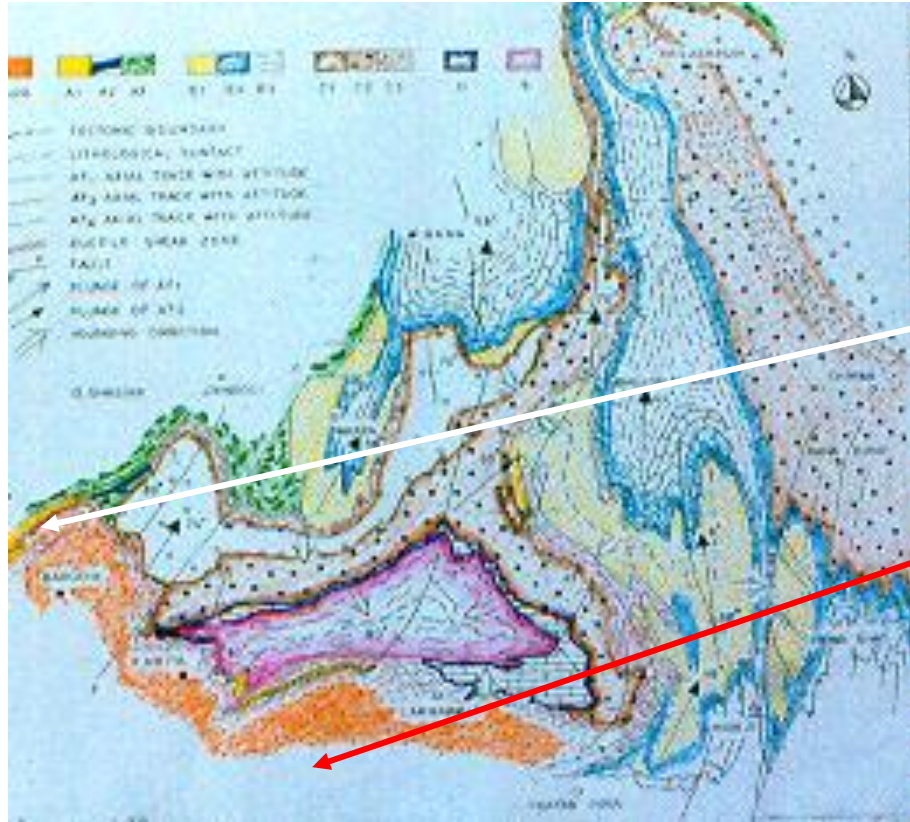
Angular unconformity between the Archaean gneiss-amphibolite-metasediment complex underlying the phosphatic stromatolite bearing Palaeoproterozoic Aravalli sequence is observed at Jhamarkotra

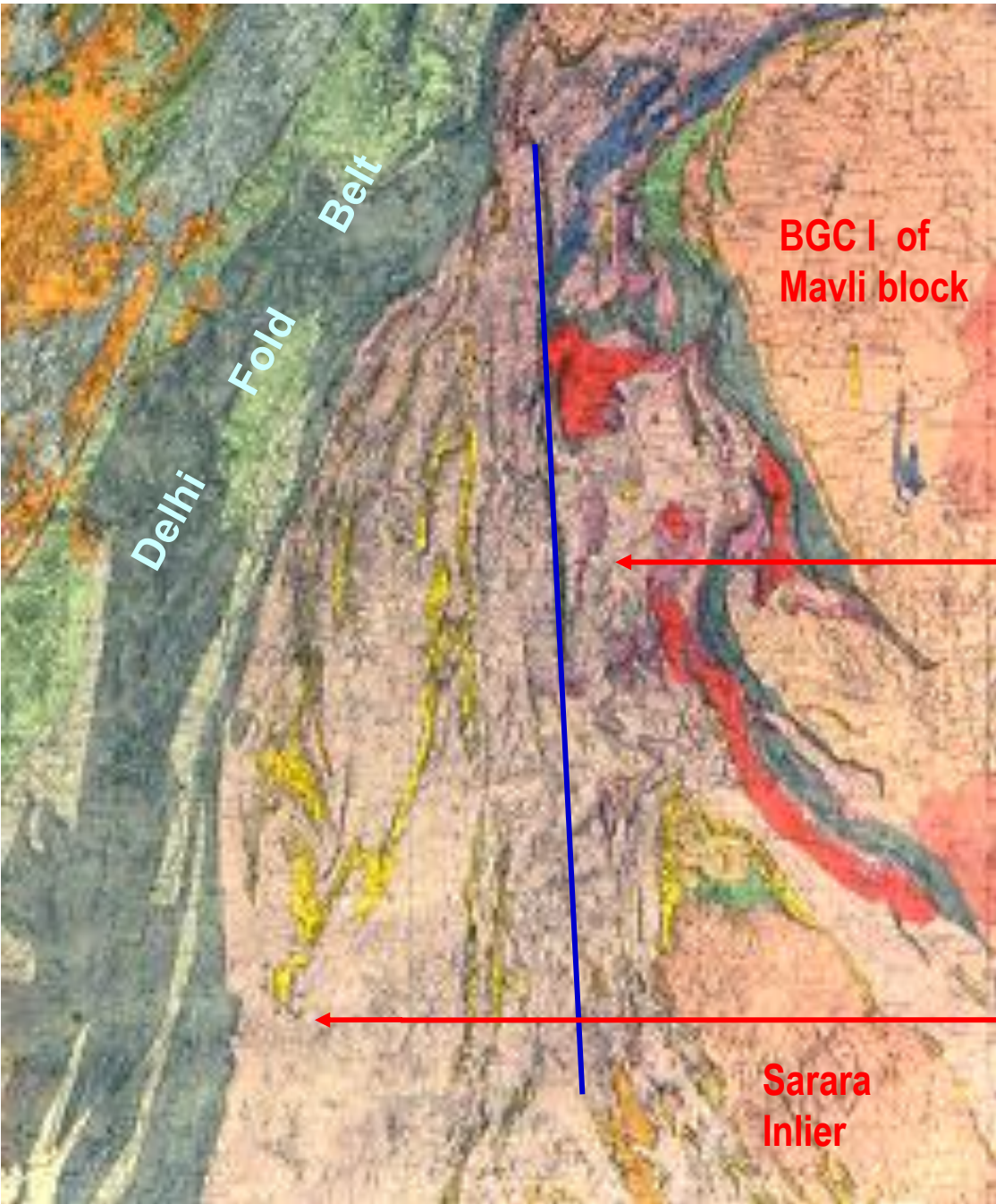


Unconformity



Palaeosols as marker of unconformity also helped identifying **Ahar River Granite (considered earlier by Heron as post-Aravalli intrusive granite) as a basement.**





Delhi Fold Belt

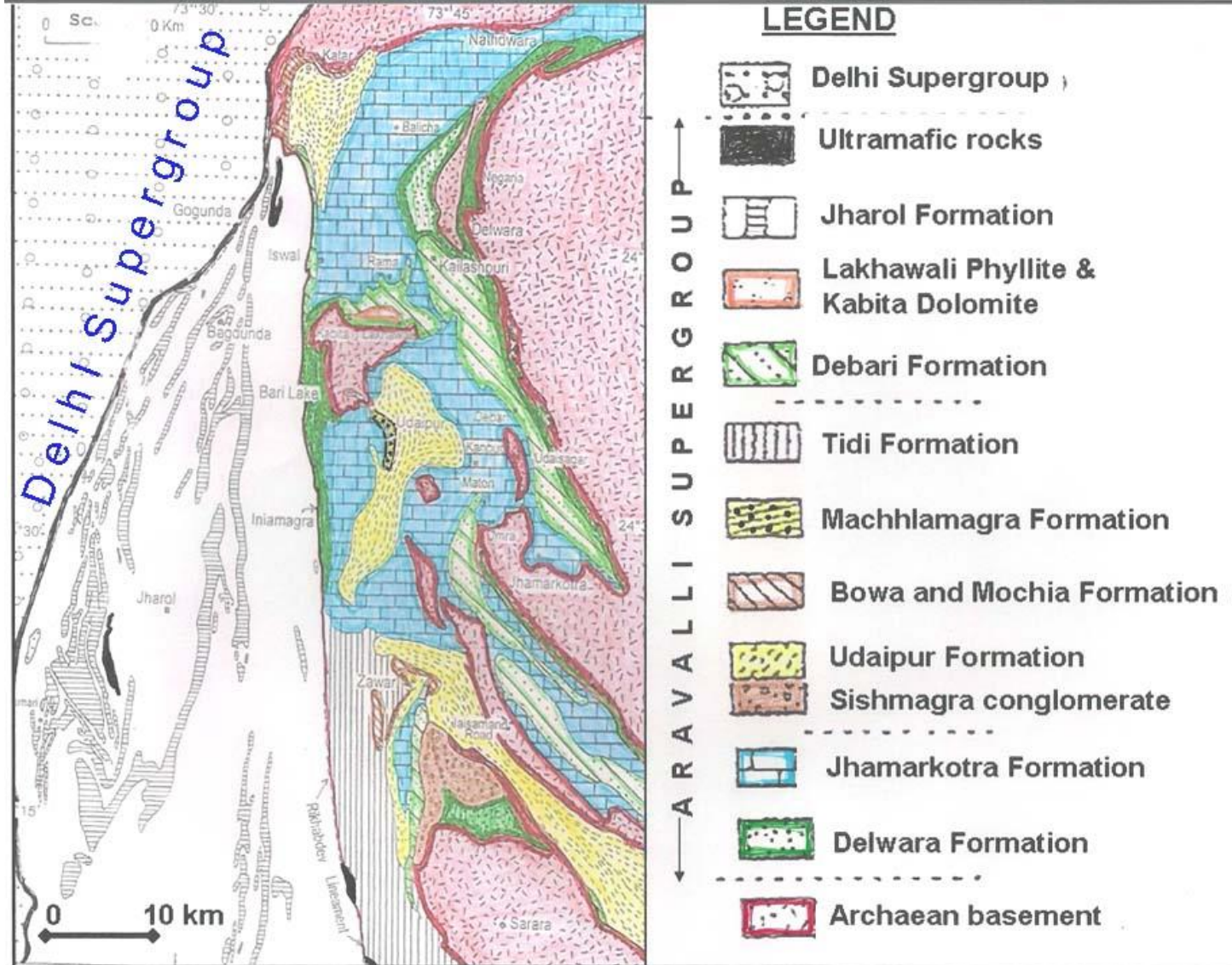
BGC I of Mavli block

Sarara Inlier

Aravalli Supergroup in the Udaipur belt is divided into a shale-sand-carbonate bearing Shallow Shelf Facies belt and a carbonate-free Deep-Sea Facies belt

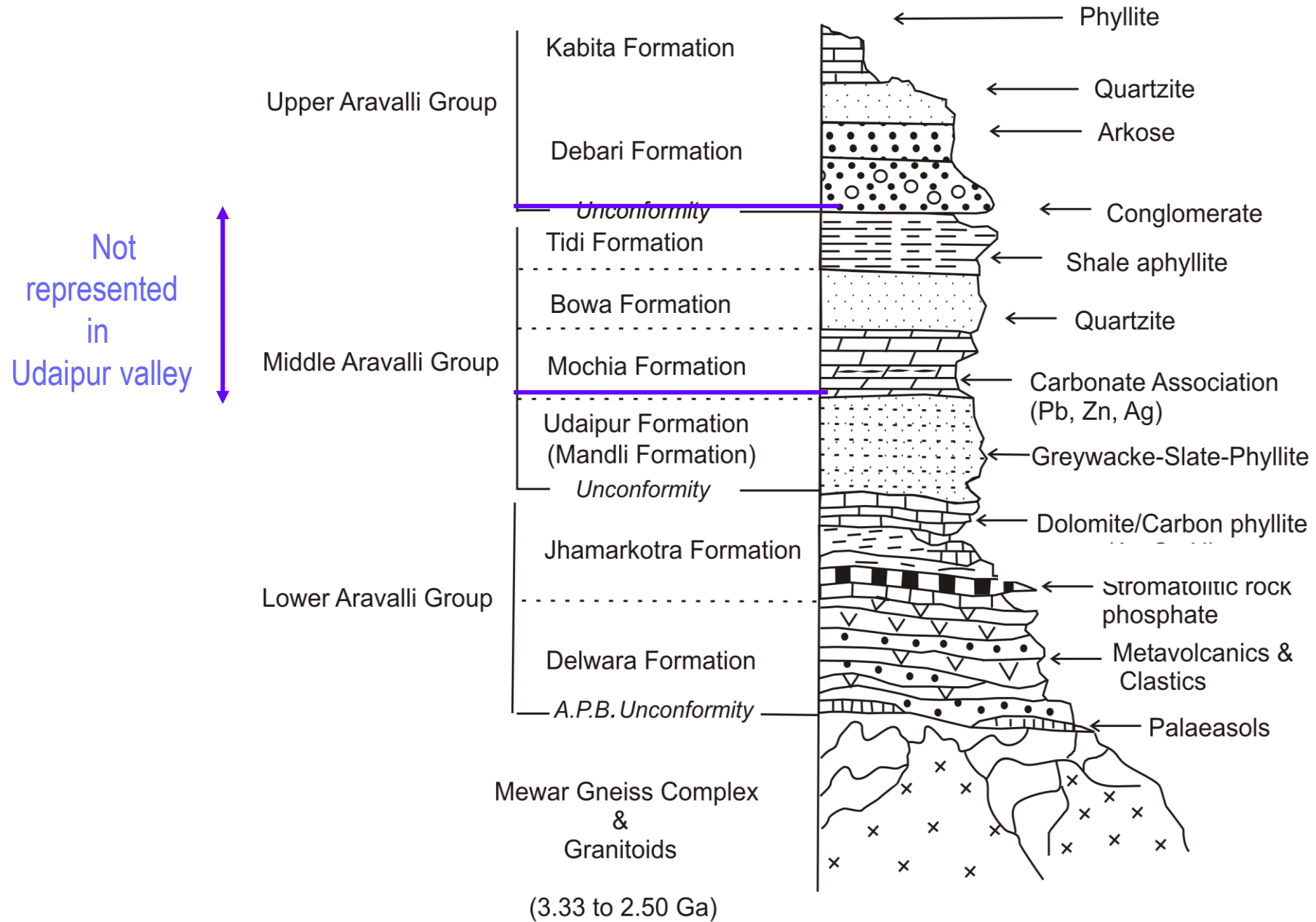
Aravalli Supergroup Shallow Shelf Facies belt

Aravalli Supergroup Deep-Sea Facies belt



Aravalli Supergroup in the Udaipur belt is divided into a Shale-sand-carbonate bearing Shallow Shelf Facies belt and a carbonate-free Deep-Sea Facies belt

Stratigraphic succession of the Shelf facies rocks of Aravalli Supergroup



Rocks of Delwara Formation



Locally developed basal conglomerate with large angular boulders



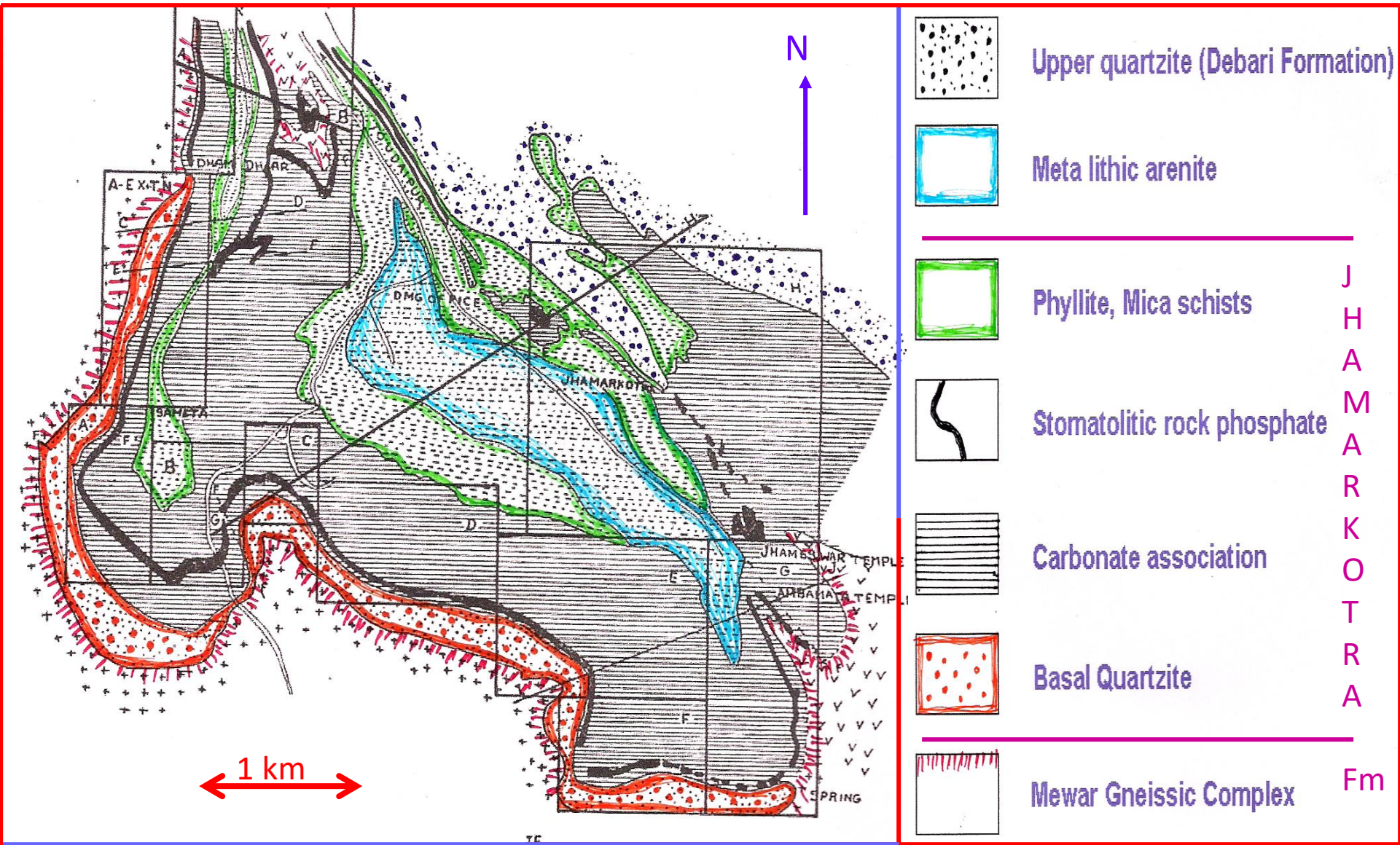
Alternating bands of mafic volcanics and quartzite



Typical basal 'monomictic' conglomerate overlain by 'ortho' quartzite



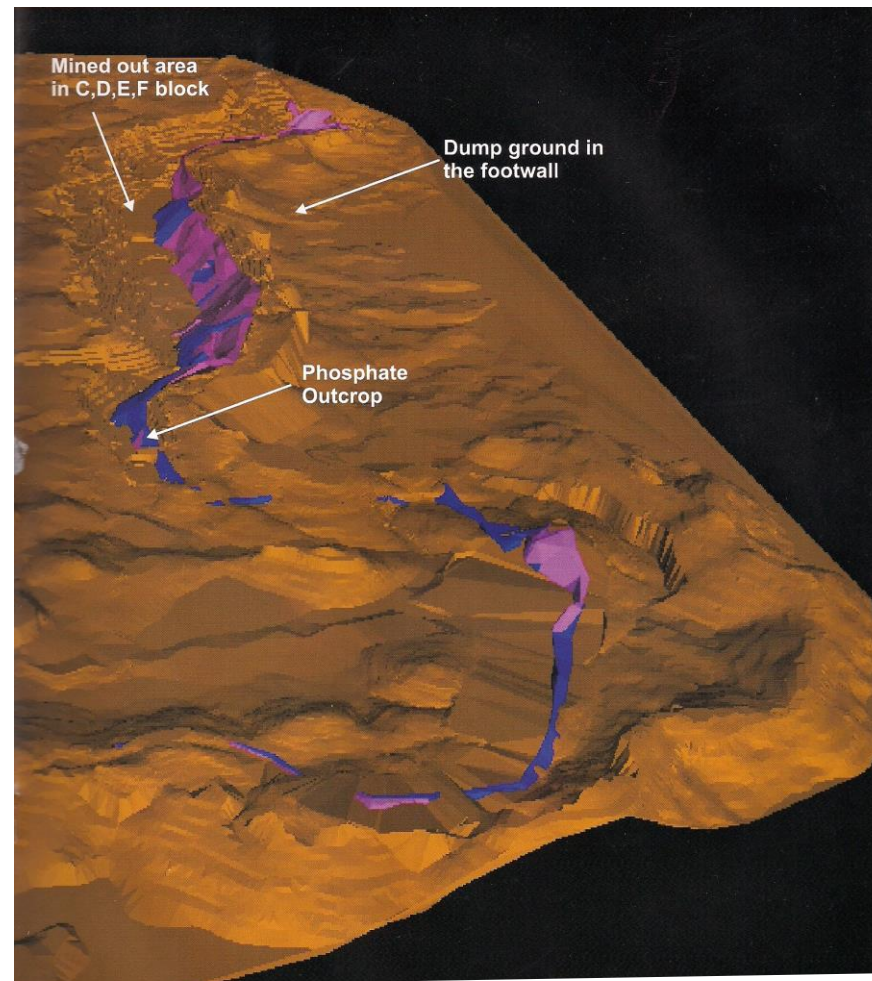
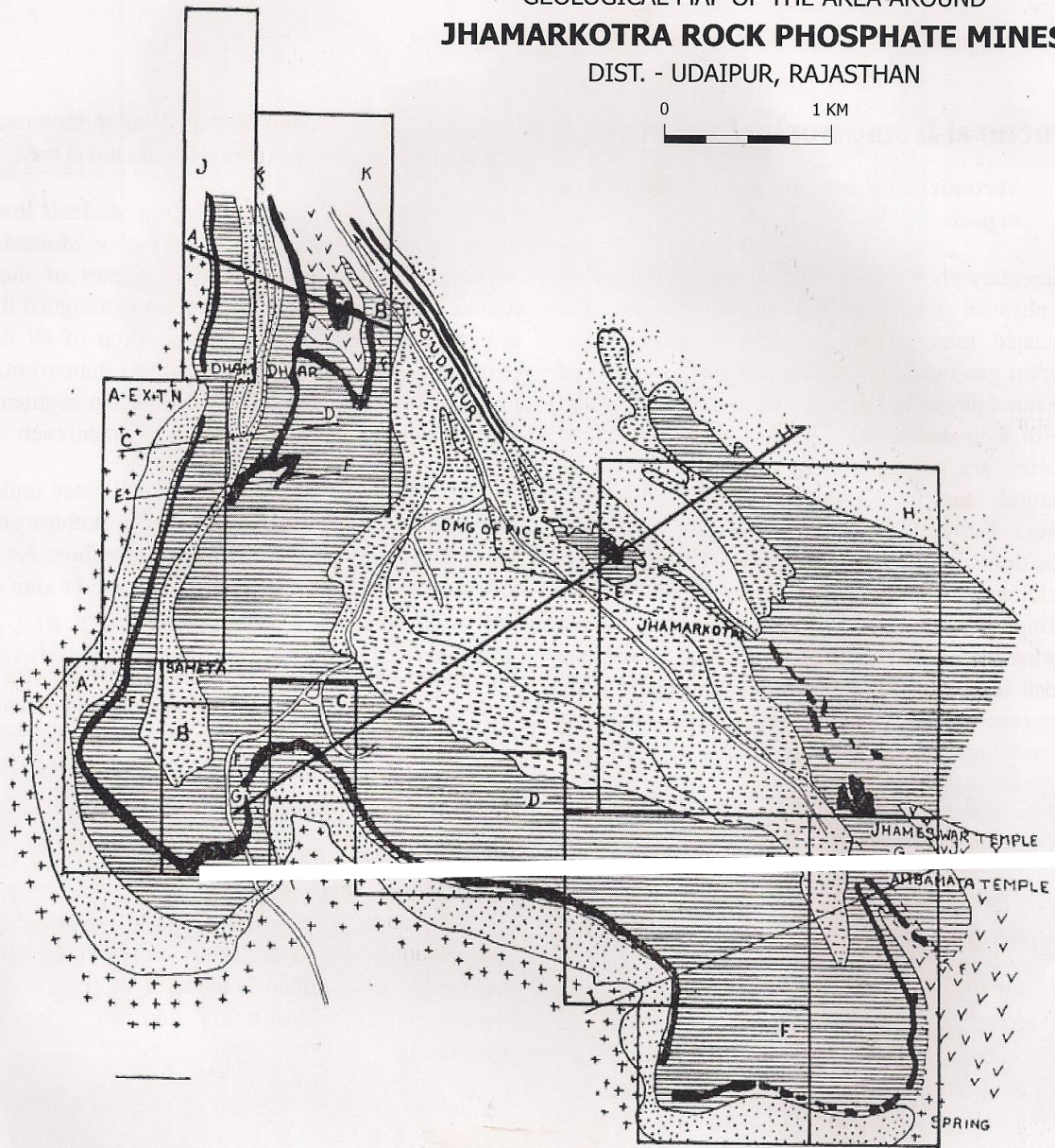
Flattened amugdules in mafic volcanics



Different members of Jhamarkotra Formation show best development at Jhamarkotra, SE of Udaipur

GEOLOGICAL MAP OF THE AREA AROUND
JHAMARKOTRA ROCK PHOSPHATE MINES

DIST. - UDAIPUR, RAJASTHAN



Computer generated 3-D view
of phosphorite band



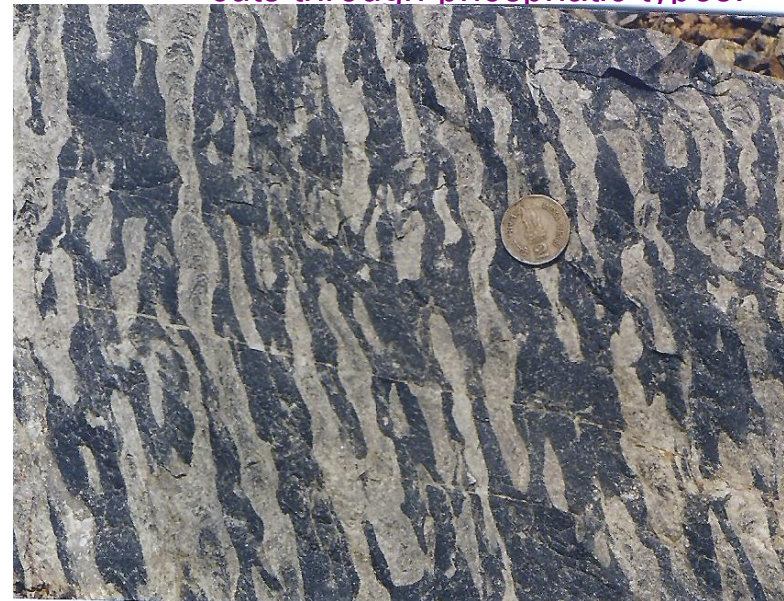
Cone-shaped non-phosphatic stromatolite



Phosphatic stromatolites rising from 'mat' stromatolite. Large non-phosphatic stromatolite cuts through phosphatic types.

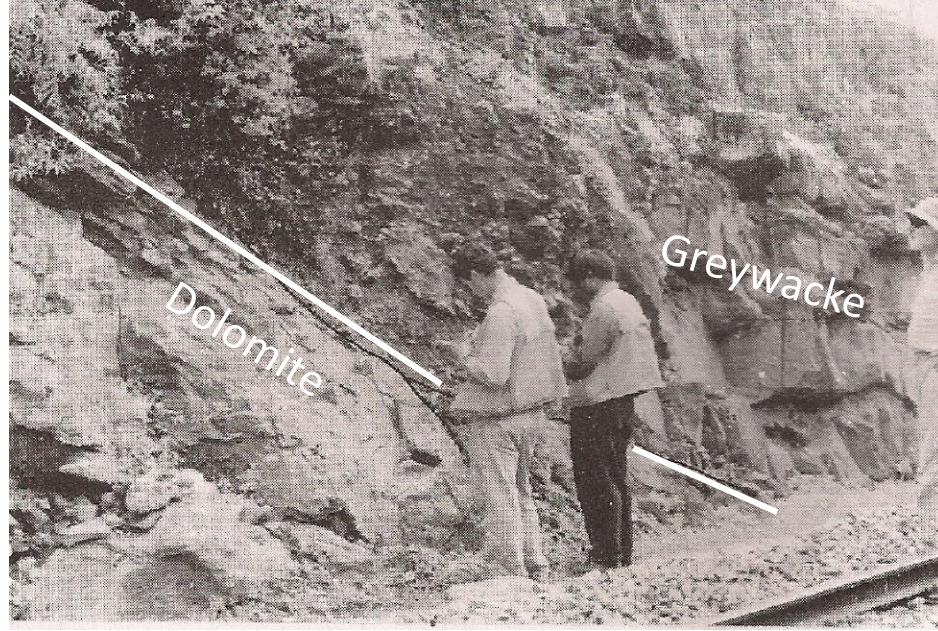


Phosphatic stromatolite columns (outcrop)

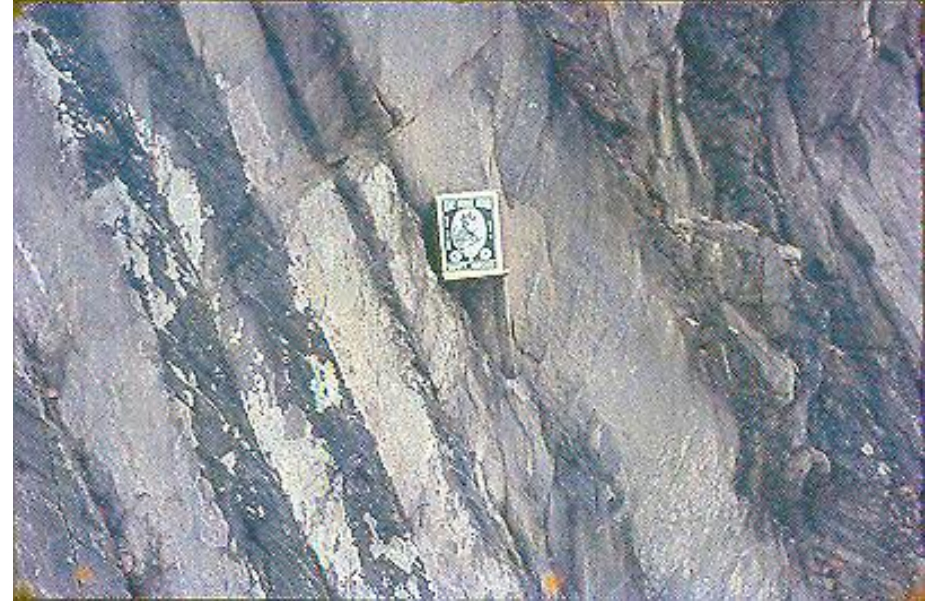


Phosphatic columns (polished slab)

Types of stromatolites in the Aravalli basins



Graded bedded greywacke (Udaipur Fm)
lying over dolomite (Jhamarkotra Fm)



Rhythmic alternation of thick beds of
greywacke and thin layers of phyllite



Graded bedding in greywacke



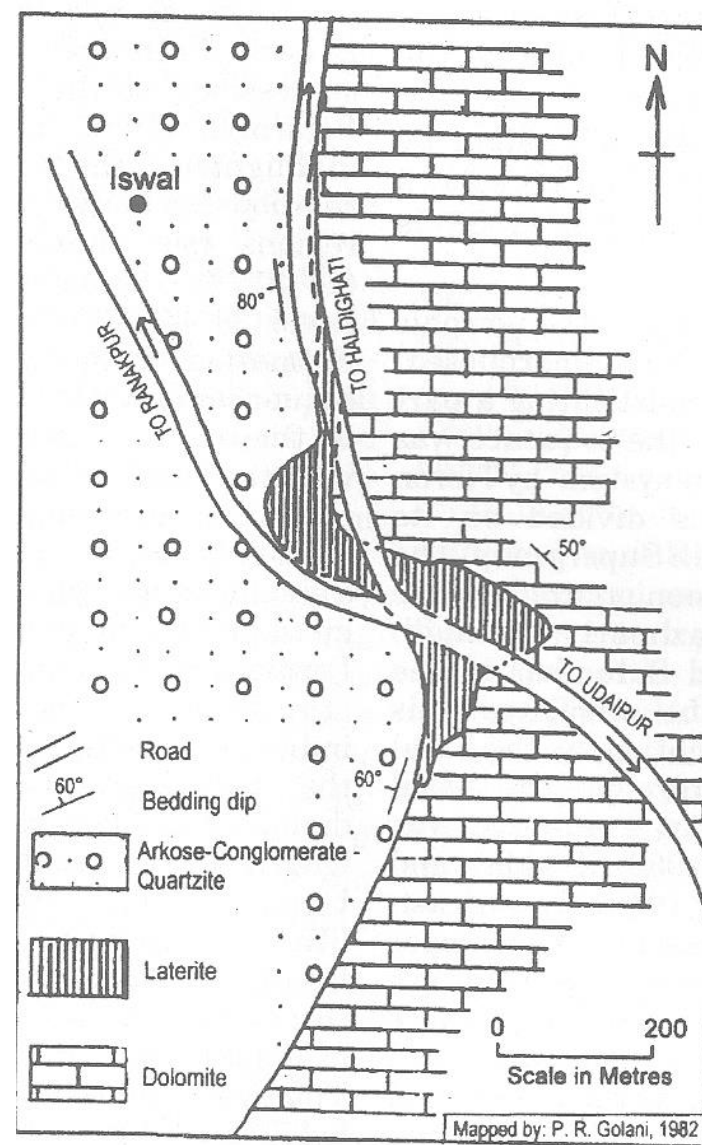
Large well-rounded boulders with
angular blocks in phyllite matrix



Vertically disposed cake-layered sequence of orthoquartzite



Profuse cross-bedding make it easier To find the direction of younging in the 'homoclinal' beds



A distinct unconformity is observed at Iswal between the carbonates of Jhamarkotra Formation and Debari conglomerate-quartzite

Aravalli formations was initially thought as Archaean ensemble.

Following features indicates that it is Proterozoic in age :

1. Stromatolitic rock phosphorite bed near to the base
2. Extensive occurrence of black shale facies rocks
3. Sporadic occurrence of quartz pebble conglomerate
4. Occurrence of sediment-hosted lead-zinc deposits
5. Large bodies of dolomitic limestone
6. Typical Proterozoic Carbon-isotope signature

Alkaline Syenites of Kishangarh

- Nepheline Syenites occur close to Kishangarh bounded with Pre-Delhi paragneisses and granodiorites possibly of rchaean reconstituted basement.
- Complexly folded initially thought to be magmatic but later on described as metamorphic in origin. Later could be by in-situ alkalisiation of Gabbro.
- 20-30% feldspathoid minerals, feldspathic ijolite containing hornblende, augite, sphene, nepheline and alkali feldspar.
- Elongate flattened dome outcrop pattern refolded into hooke-shaped body. Mylonitized slivers along eastern contact. Capping of fenitized rocks in discontinuous pattern. Deformation is synkinematic associated with evolution and ascent of the syenite body

Age of the Aravalli Supergroup

- ❖ There is no well constrained radiometric dates available for the Aravalli Supergroup.
- ❖ Cratonisation of basement at 2500 Ma is the **maximum** age of Aravalli Supergroup.
- ❖ The **minimum** age is ca. 1850 Ma given by which is the age of earliest folding of the ensemble.

Age of the Aravalli Supergroup

- ❖ Pb-Pb model age reported from galena separated barite in the basal volcanic succession indicates 2024 and 2150 Ma as the earliest depositional age.
- ❖ Pb-Pb isochron age of 2273 +/-3 reported from dolomitic carbonatite of Newania, east of Udaipur is thought as an indirect evidence about max age of Aravalli Supergroup is (correlating carbonatite with basin opening extensional stress).
- ❖ Sm-Nd model ages of around 2200 Ma from Basal volcanics further hints at the maximum age of the Aravalli Supergroup
- ❖ All these ages suggest the opening of the Aravalli basins initiated at around or earlier than 2200 Ma.
- ❖ Thus assuming that the Aravalli basement cratonised around 2500 Ma, a hiatus of about 300 Ma along the Archaean-Proterozoic boundary is suggested.

Litho-stratigraphic units	Tectonic setting	Age (Ma)	References
Marwar Supergroup	Stable cratonic basins	~543-635	Kaufman et al., 2006
Malani Group = Sindredth Group	Plume related magmatism; opening of shallow basins	~ 720 -- 780	Aswathnarayan, 1964; Crawford & Compston, 1970; Gregory et al. 2009; Rathore et al. 1999.
Sirohi Group Sirohi Orogenic Cycle	Basin opening	~852	Bhowmik et al. 2010; Choudhary et al. 1984; Deb et al. 1989; Fariduddin & Kröner, 1998; Volpe & Macdaugall, 1990.
	Basin opening	~1000	
Delhi Supergroup Delhi Orogenic Cycle	Basin closing	~1450	Choudhary et al. 1984 Roy and Das 1985
	Basin opening (Emplacement of Sandmata Granulites)	~1725	Sarkar et al. 1989 Buick et al. 2006 Fareeduddin & Kröner, 1998 Roy et al. 2005, 2012
Aravalli Supergroup Aravalli orogenic Cycle	Basin closing	~1900-1850	Choudhary et al. 1984 Roy et al. 2012 Sarangi et al. 2006
	Basin opening	~ 2100-2200	Deb and Thorpe , 2004 Schleicher et al. 1997
Banded Gneissic Complex & Granitoids (Archaean Basement)	~2500 to ~3300		Gopalan et al. 1990 Roy & Kröner1996 Wiedenbeck & Goswami, 1994 Wiedenbeck et al. 1996a