

Growth of the Eastern Dharwar Craton in the Proterozoic

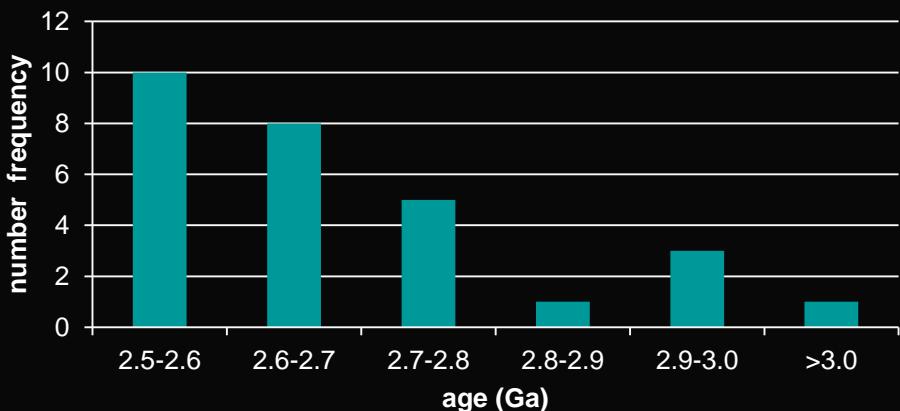
Dilip Saha

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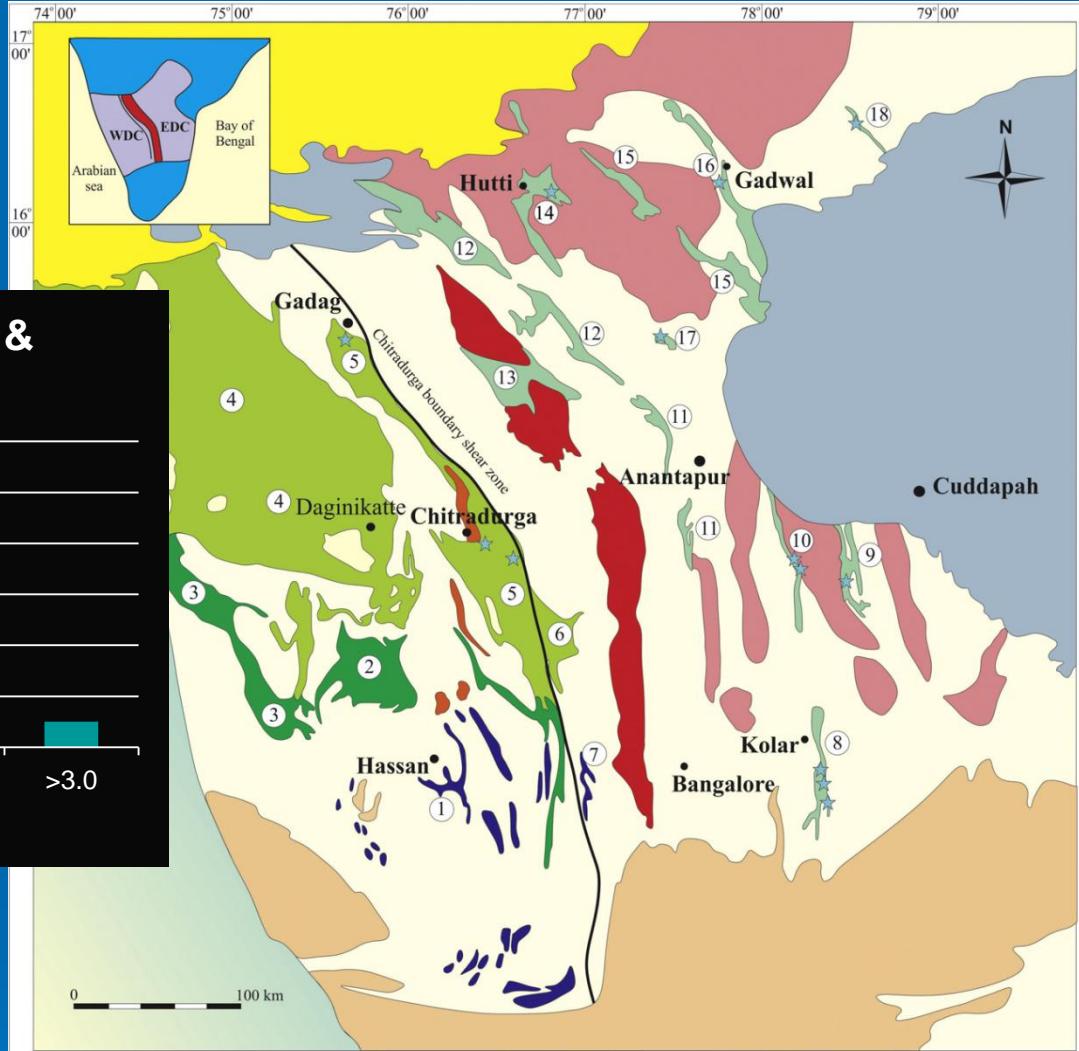
E-mail: dsaha@isical.ac.in

Current Science Meeting 28-29 November 2015

greenstone belt ages (Ga), EDC & WDC



Geological map after published GSI maps; Jayananda et al. 2012; age data compiled after Jayananda et al. 2012, PR



Legend

- 2.61 Ga high-K plutons
- EDC greenstone belts
- Chitradurga Group
- Bababudan Group
- Sargur Group
- TTG gneisses

- Deccan basalts
- Proterozoic cover
- Charnokites
- Closepet batholith
- EDC plutons

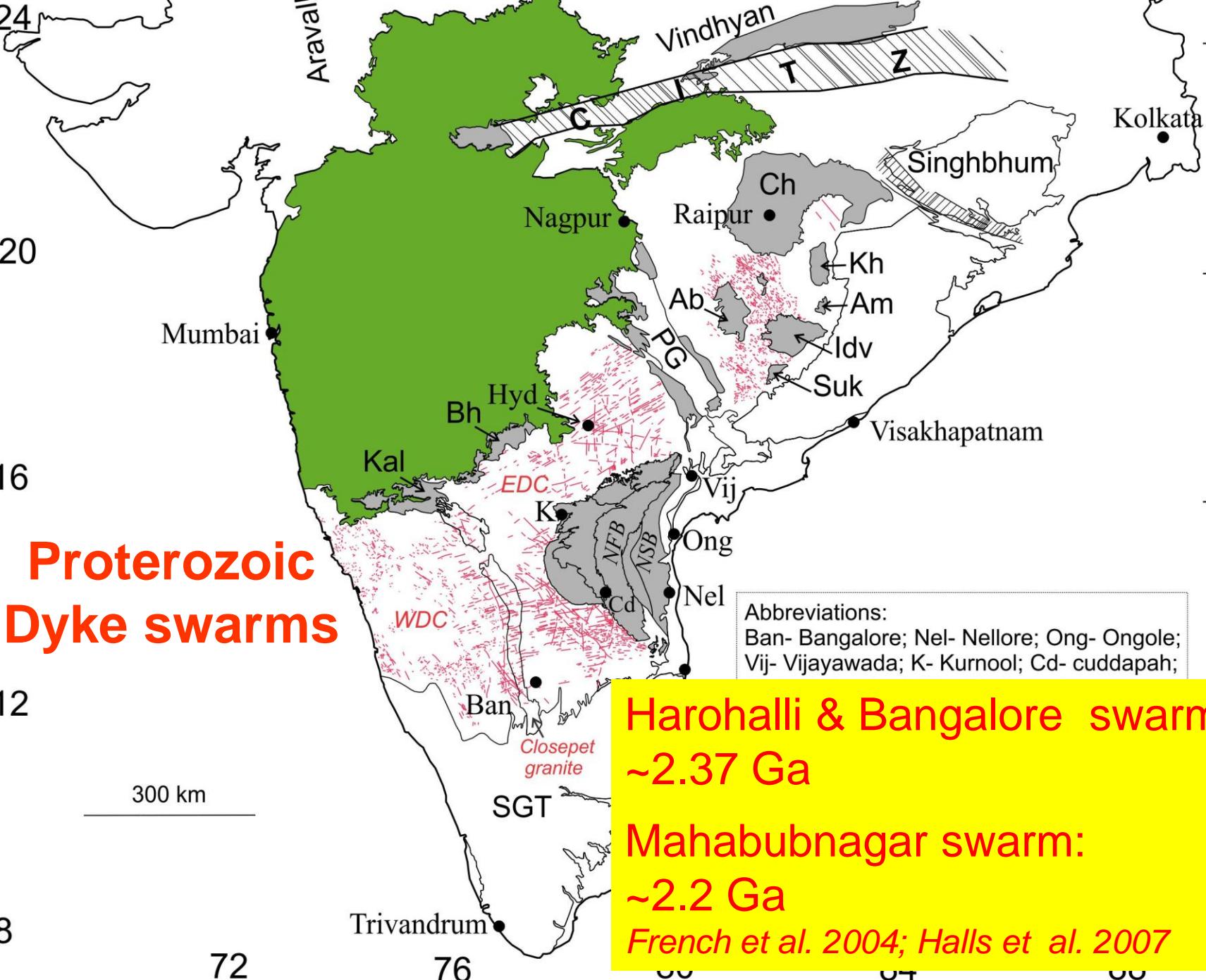
Greenstone belts

- | | |
|-----------------|---------------|
| 1. Holenarsipur | 10. Kadiri |
| 2. Bababudan | 11. Ramagiri |
| 3. Kudremukh | 12. Kushtagi |
| 4. Shimoga | 13. Sandur |
| 5. Chitradurga | 14. Huttī |
| 6. Javanahalli | 15. Raichur |
| 7. Kunigal | 16. Gadwal |
| 8. Kolar | 17. Jonnagiri |
| 9. Veligallu | 18. Peddavuru |

EDC GROWTH SINCE 2.5 Ga

Clues from

- ❖ Dyke swarms
- ❖ Large intracratonic basin: Cuddapah
- ❖ Fold & Thrust Belts
- ❖ Exhumed orogen, EGB (Ongole domain)

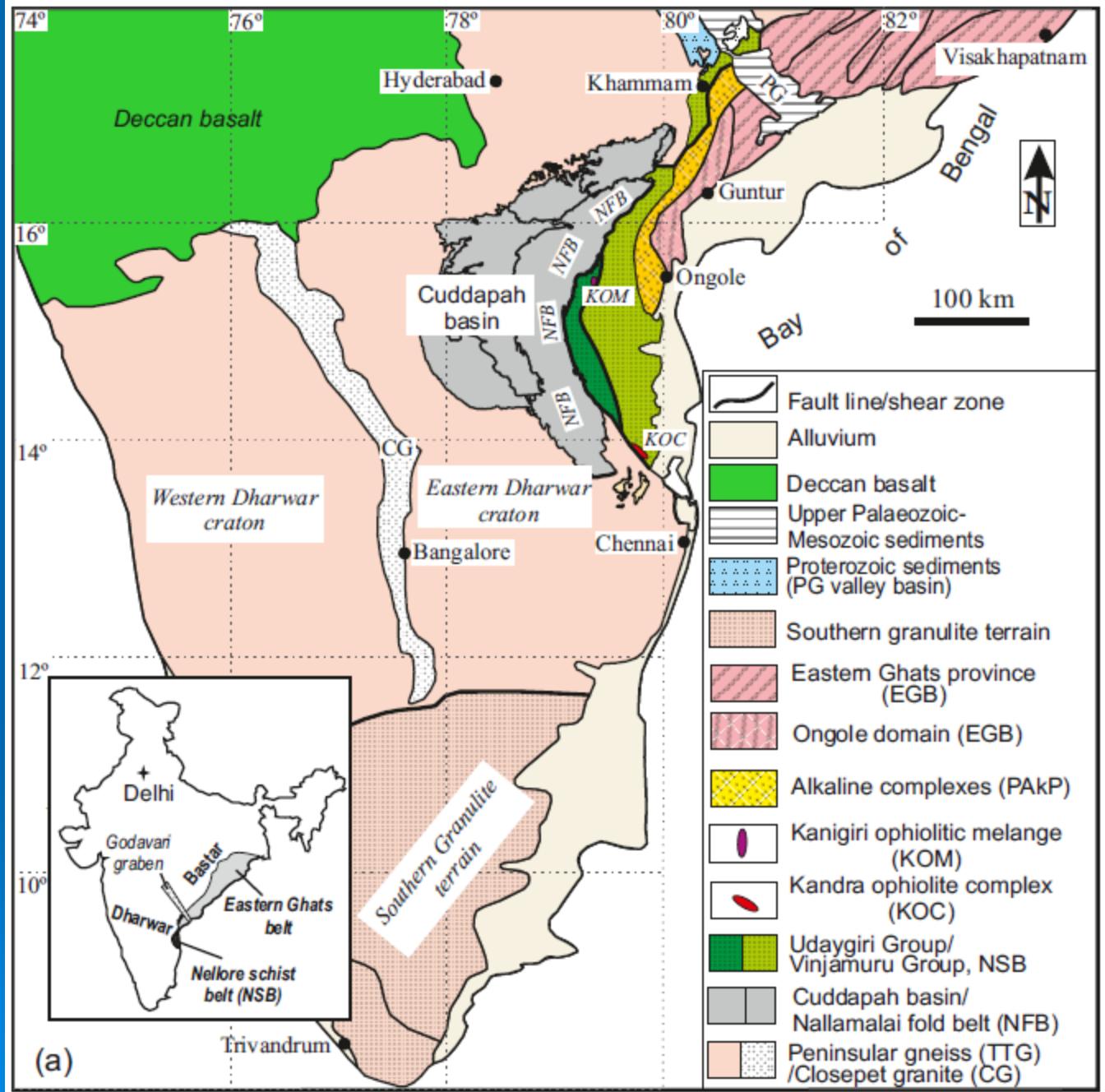


Harohalli & Bangalore swarm:
~2.37 Ga

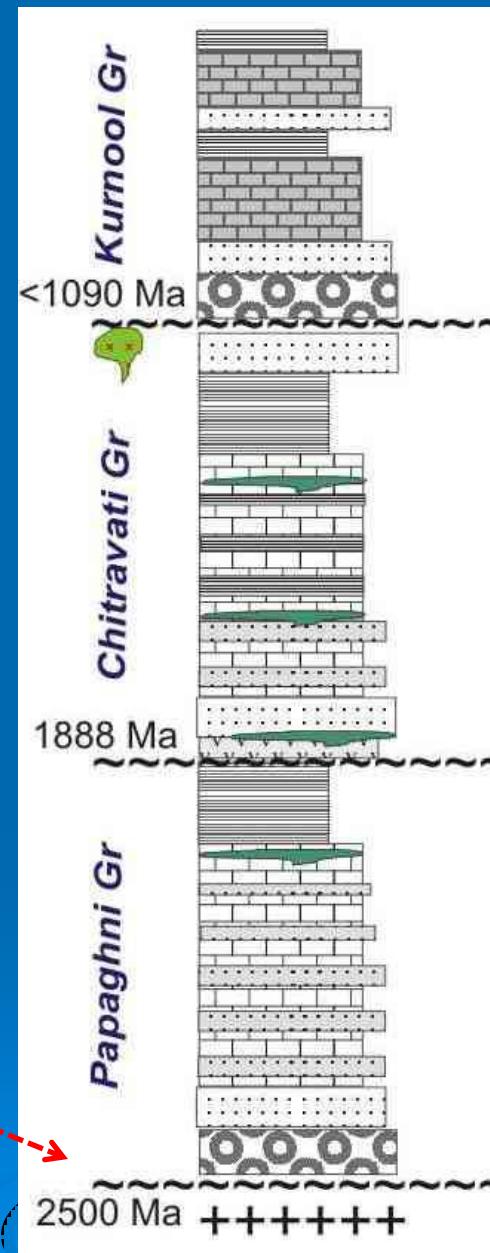
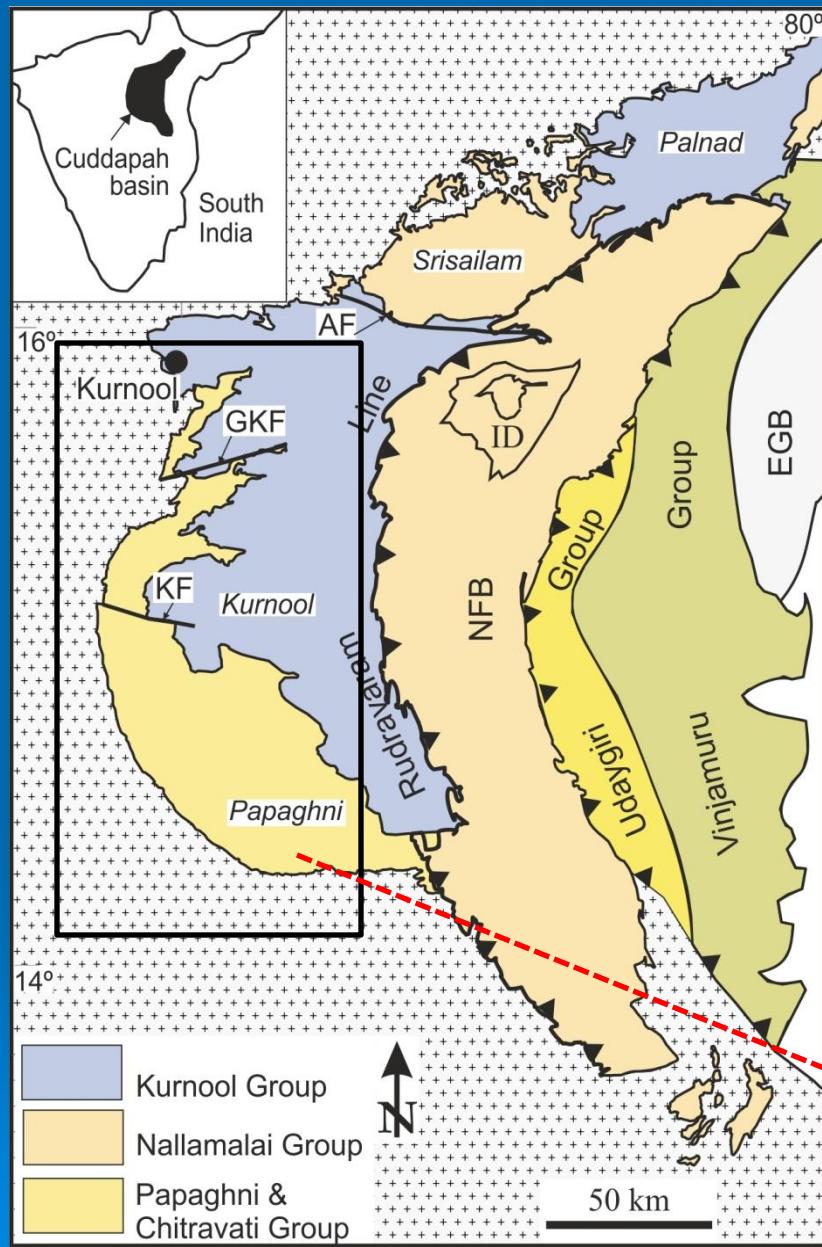
Mahabubnagar swarm:
~2.2 Ga

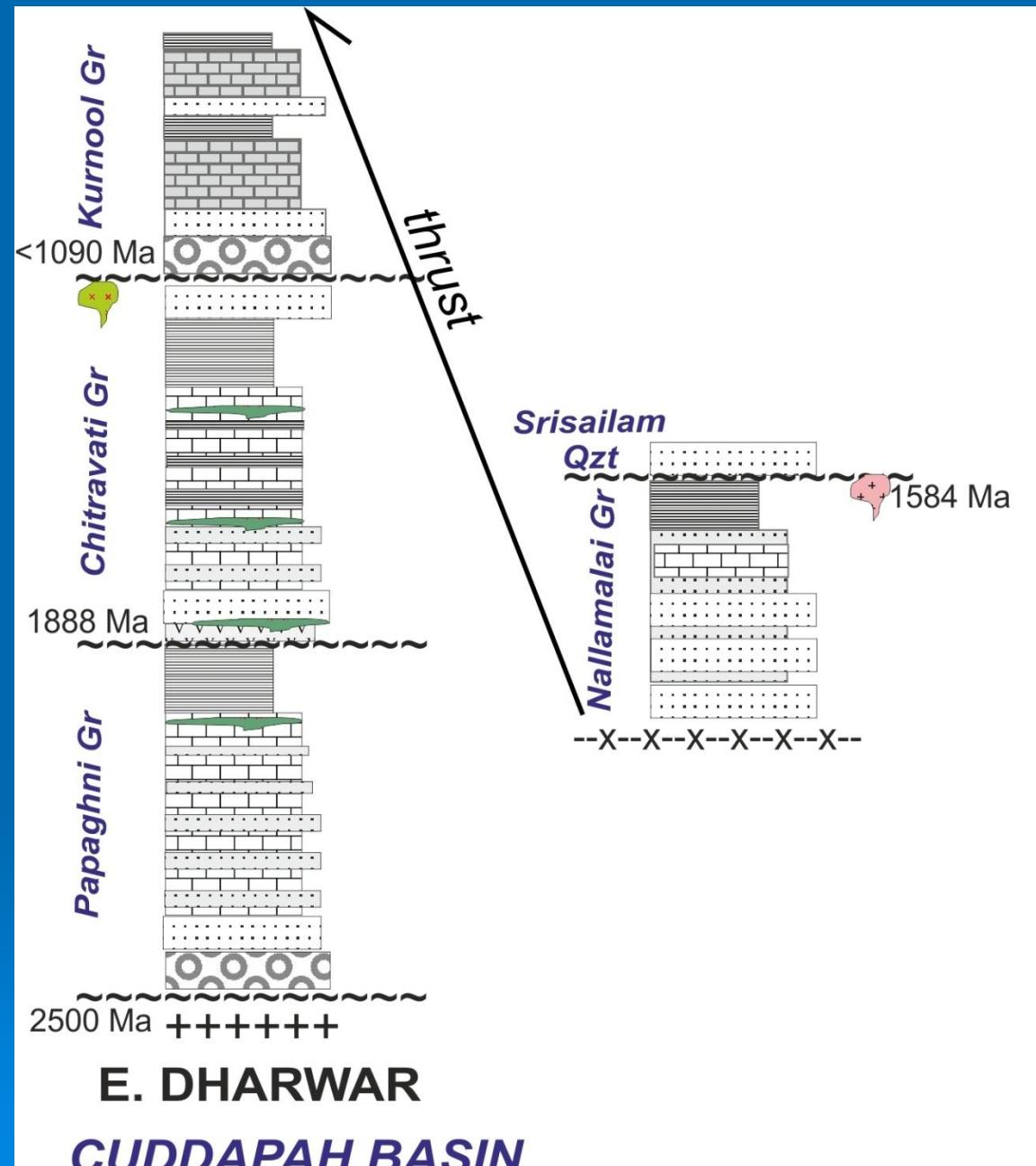
French et al. 2004; Halls et al. 2007

Dharwar craton and its SE margin

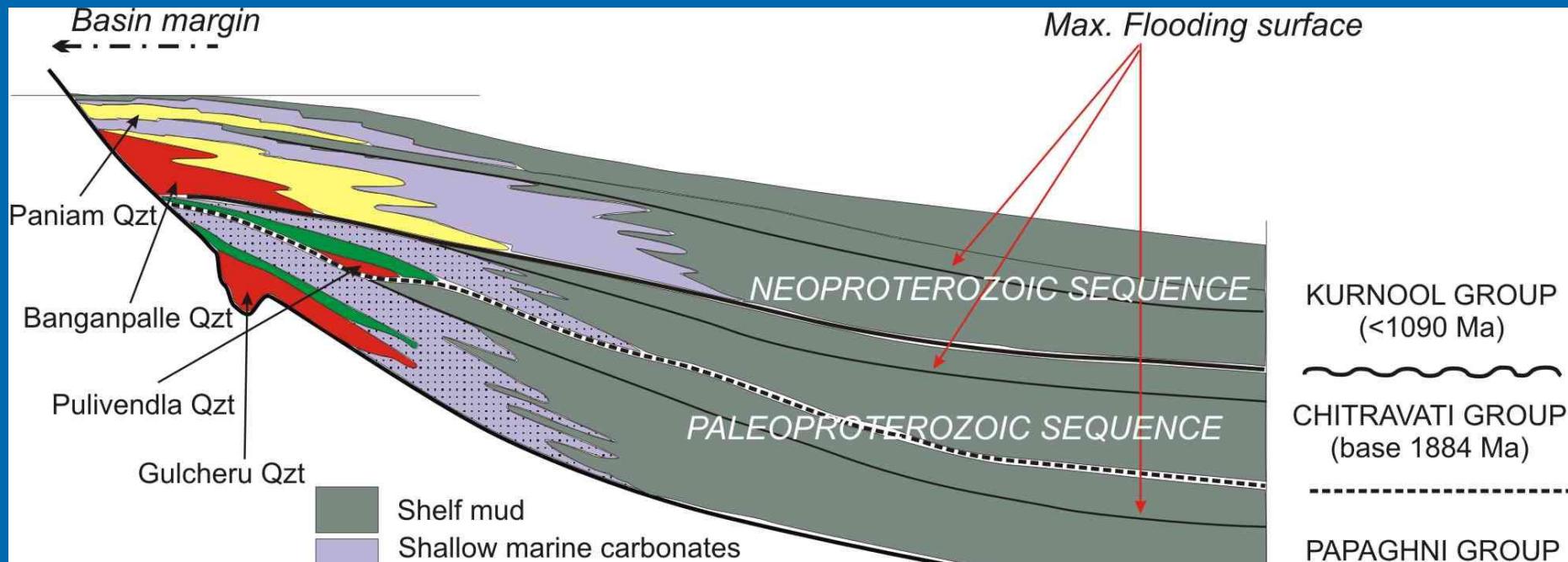


- ❖ Large intracratonic basin: Cuddapah
- ❖ Sedimentary sequence
- ❖ Regional implications



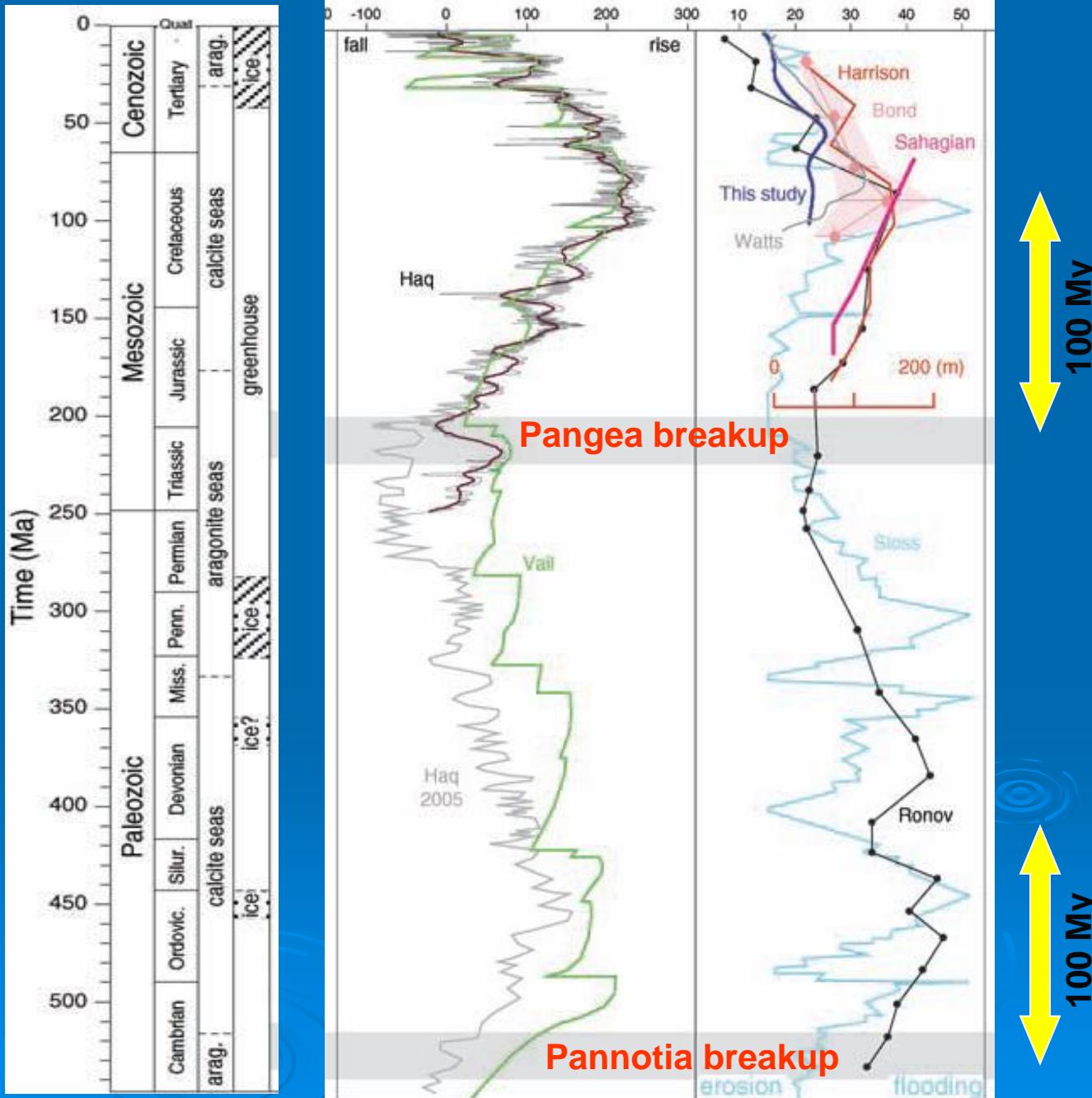


- ❖ Nallamalai Gr (NFB) allochthonous
- ❖ Tectonically transported over Kurnool & older Cuddapah succession
- ❖ Deep water Narji Lst : open sea to the east of Kurnool basin
- ❖ Nallamalai & Vellikonda ranges were non-existent during Kurnool sedimentation



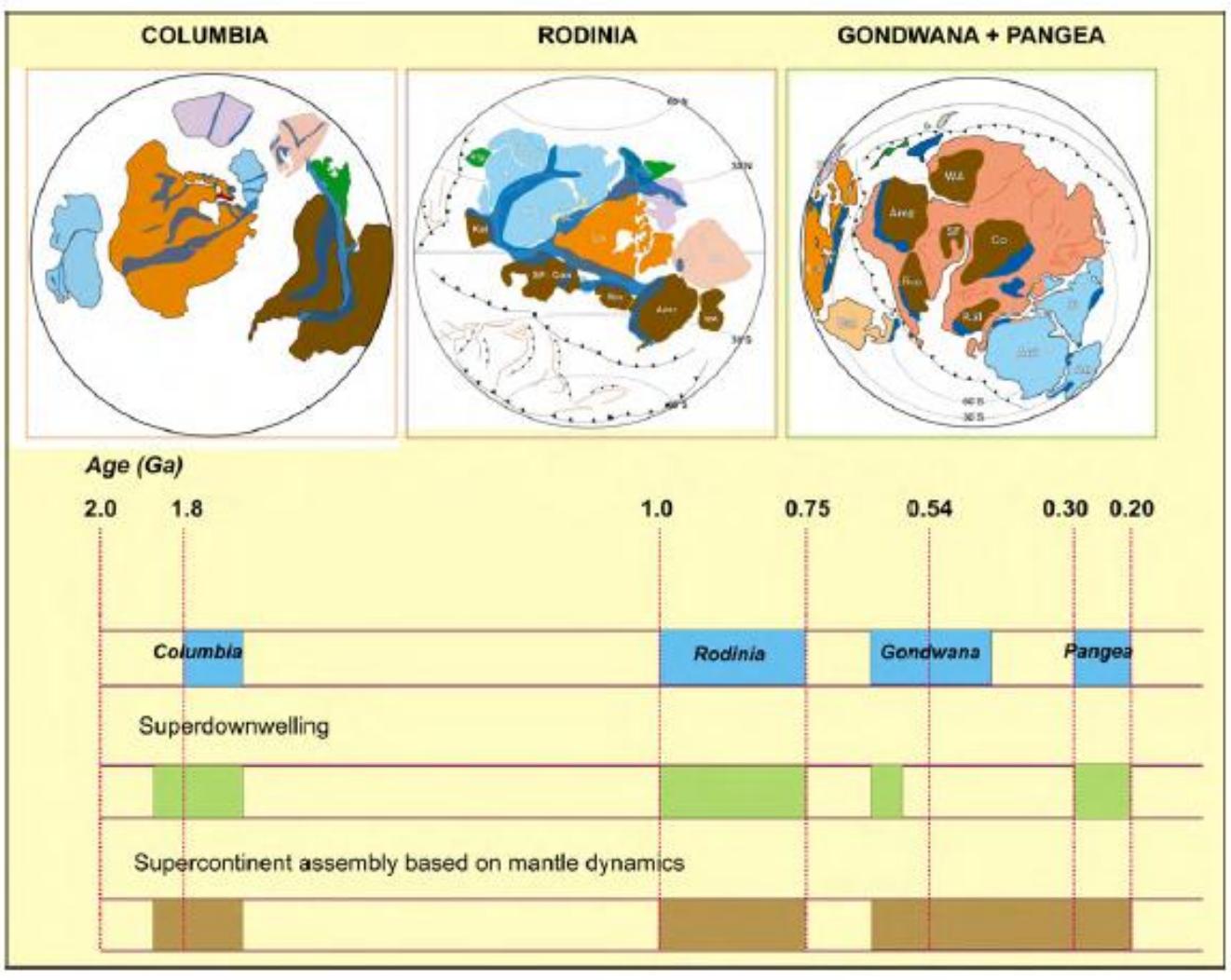
Sketch section across Cuddapah basin (Papaghni & Kurnool subbasins). Possible sequence boundaries and maximum flooding surfaces shown. Note major erosional unconformities (bold solid lines).

Phanerozoic sea level changes and relation with supercontinent break-up

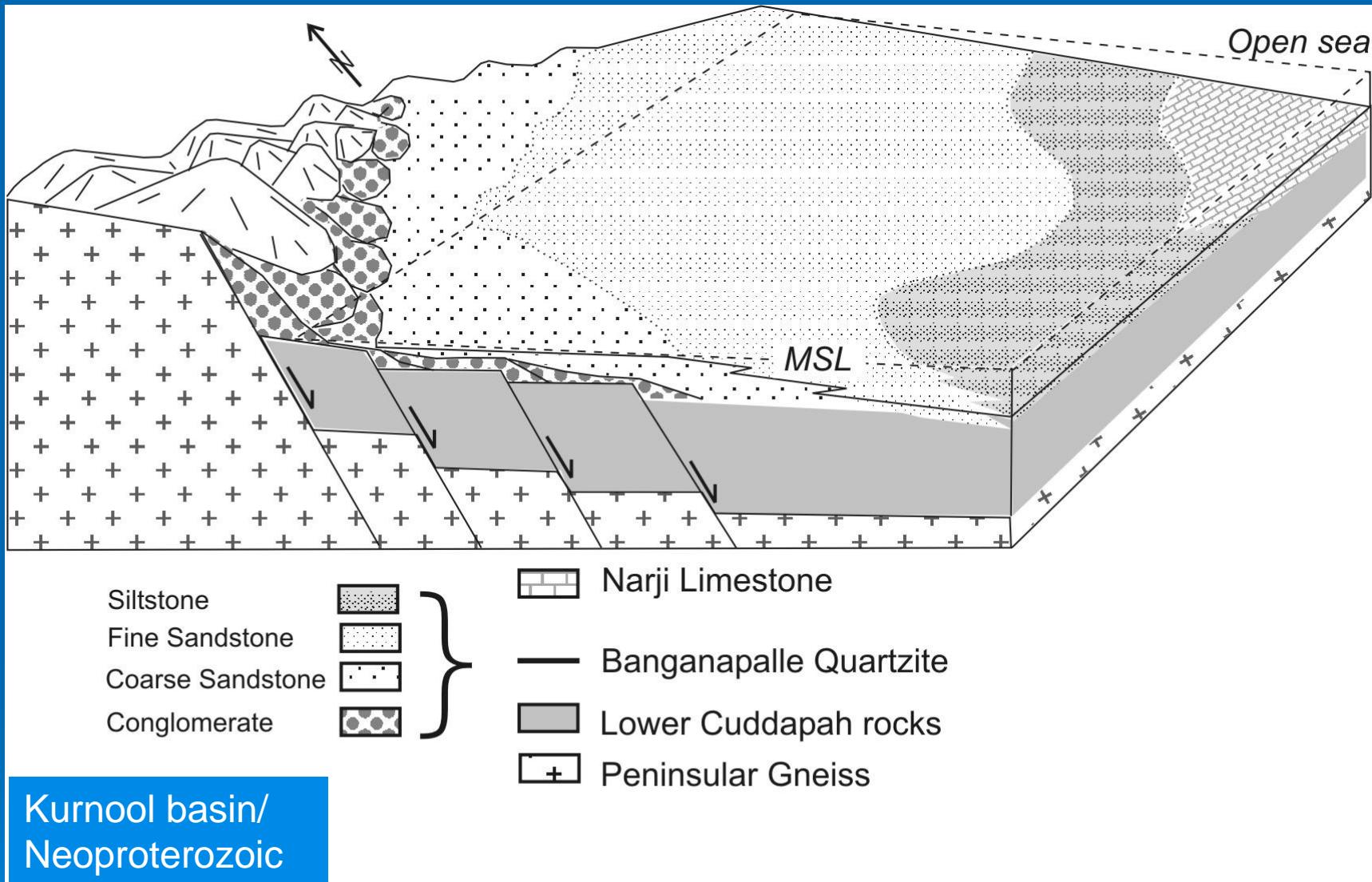


Stratigraphic sequences in Cuddapah basin

- Two regional/ major erosional unconformities
- 3 max flooding surfaces/sea level rises
- Oldest flooding c.1800+ Ma: related to Columbia break-up (?)
- Max sea level rise during Kurnool sedimentation: Rodinia break-up (?)



Senshu et al. 2009, GR



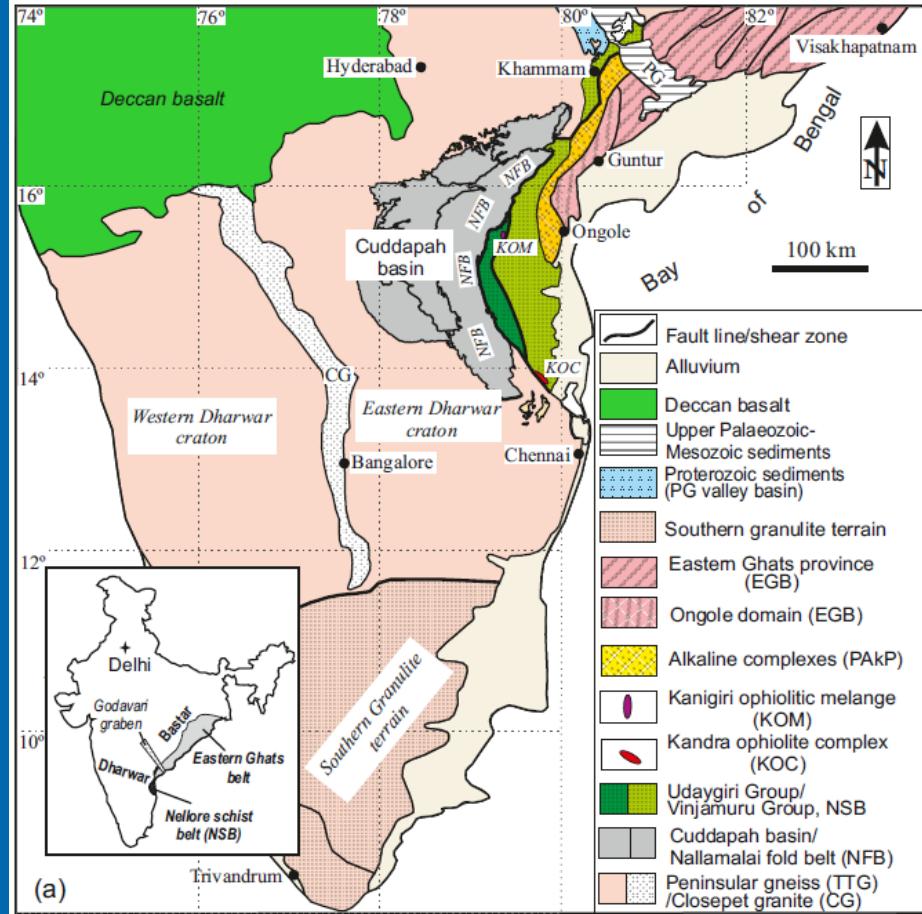
Nallamalai & Vellikonda ranges were
yet to emerge!

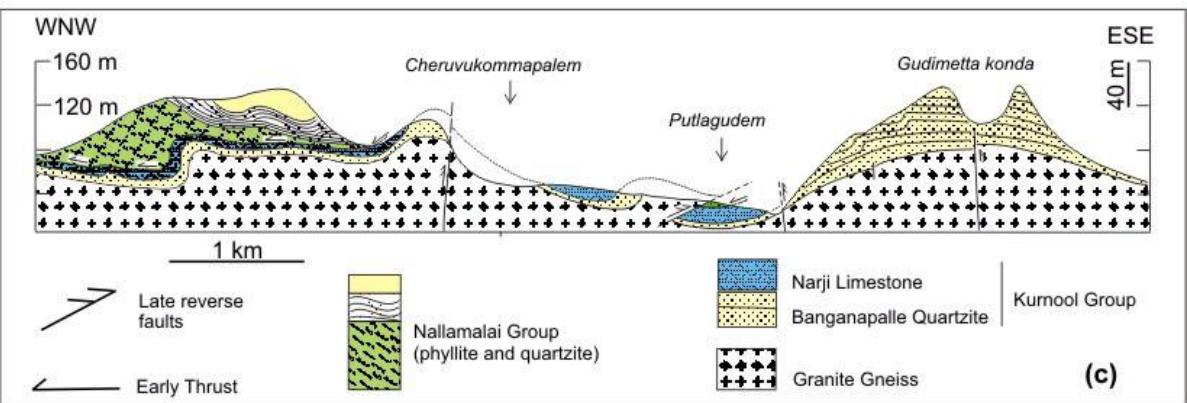
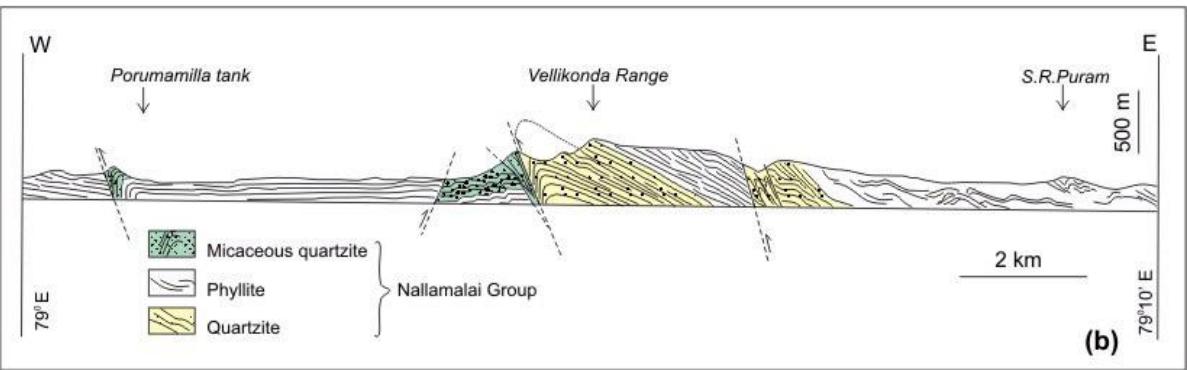
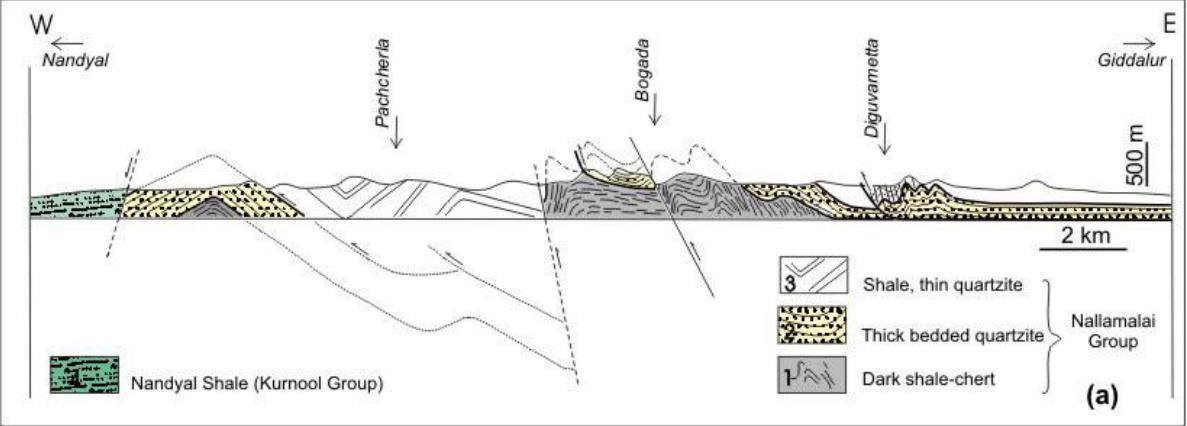
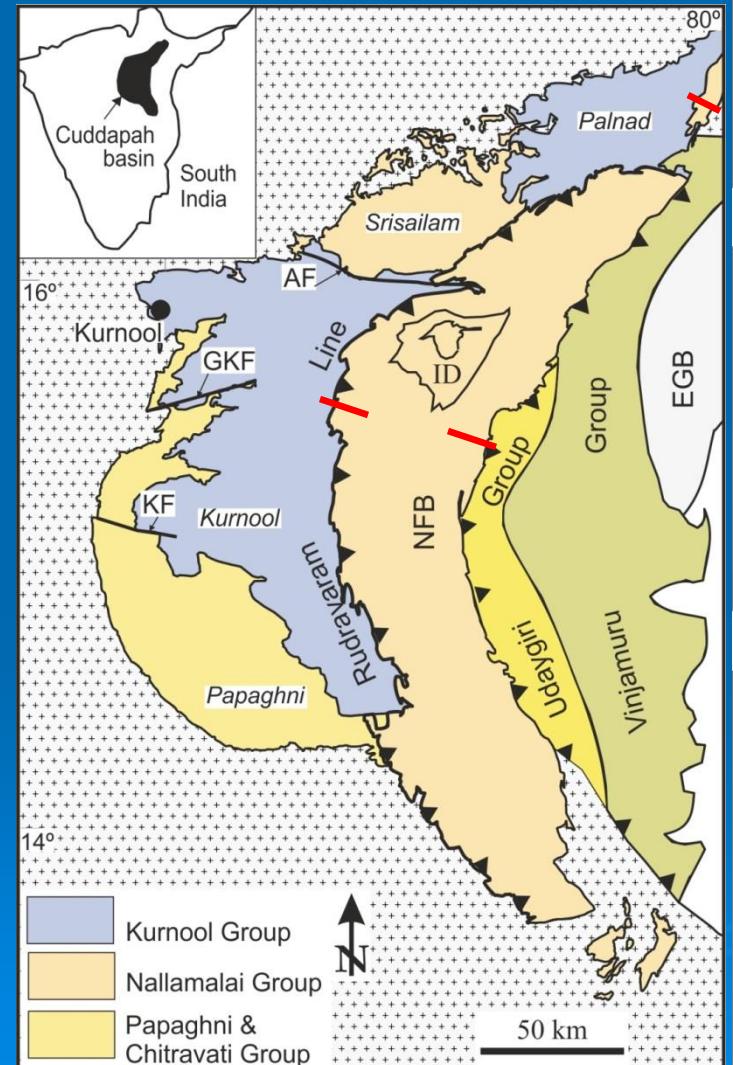
❖ Fold-and-thrust belts

❖ Nallamalai fold belt

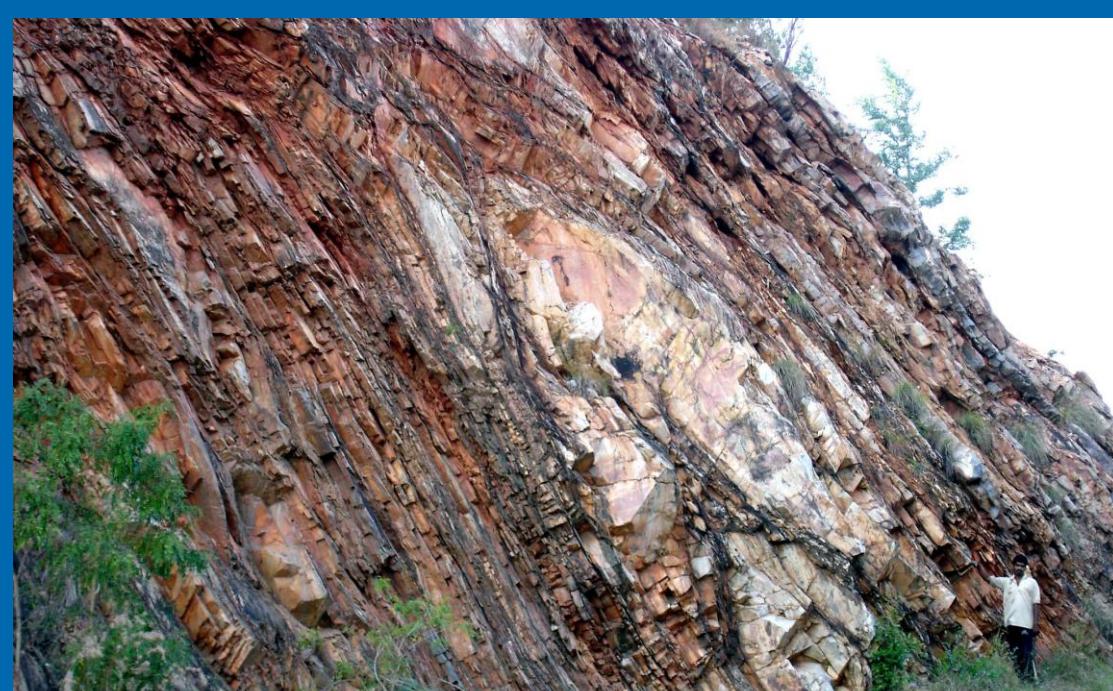
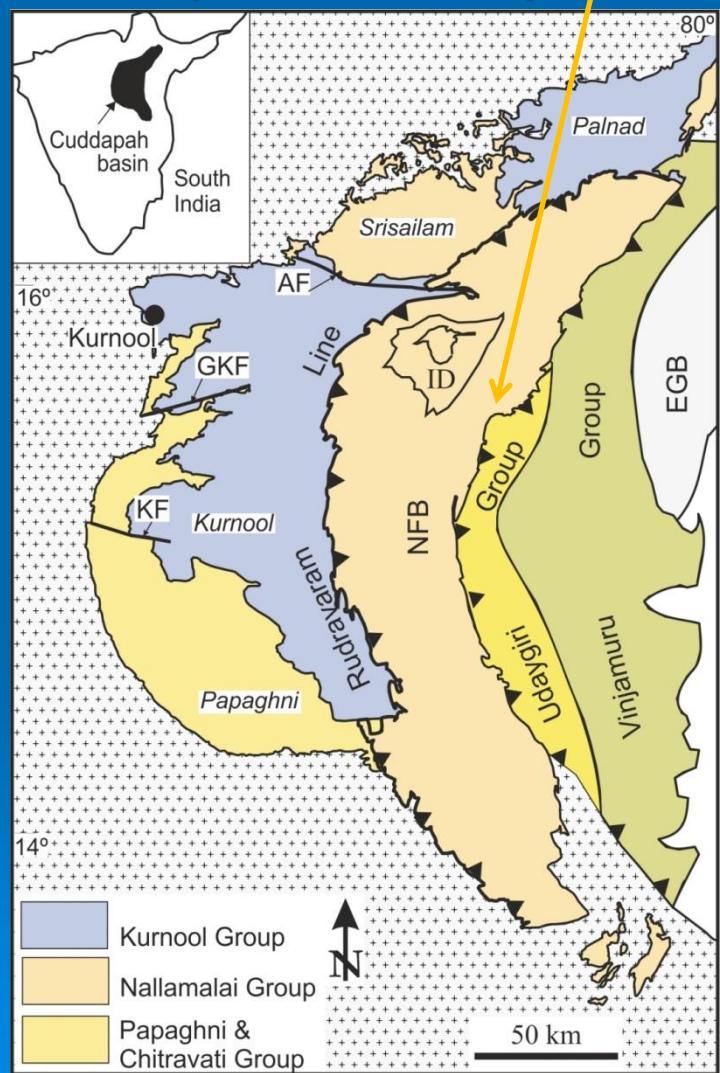
❖ Boundary thrusts

- W boundary: Maidukuru thrust
- E boundary: Vellikonda thrust front

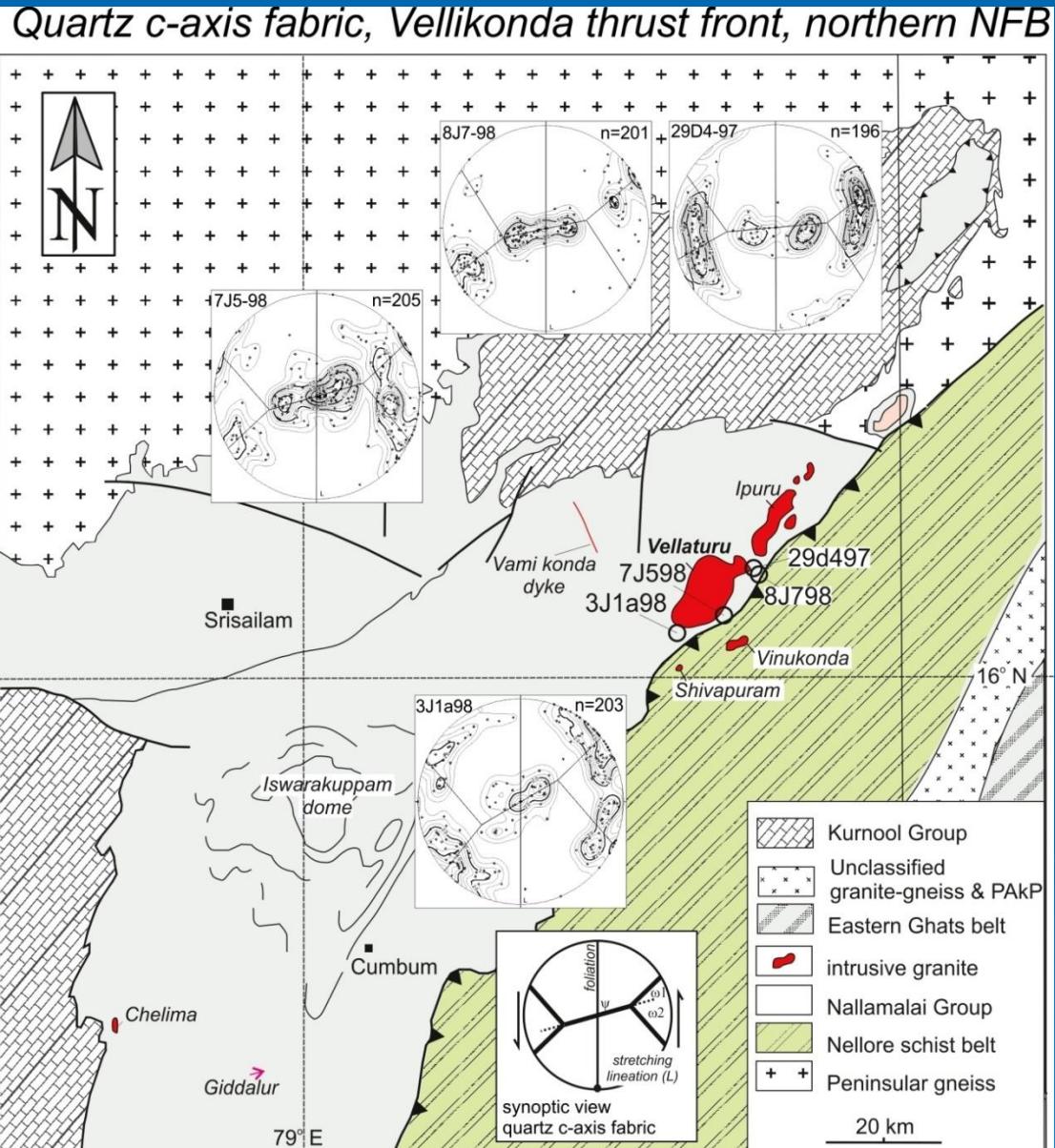
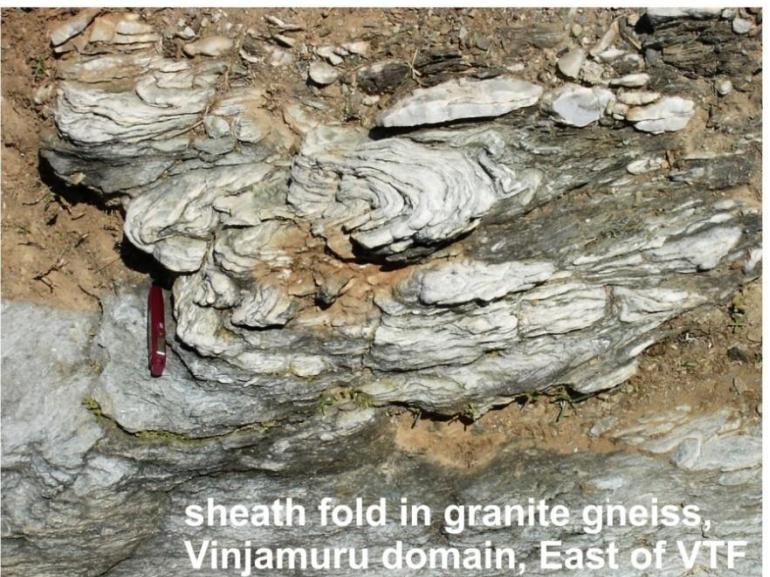


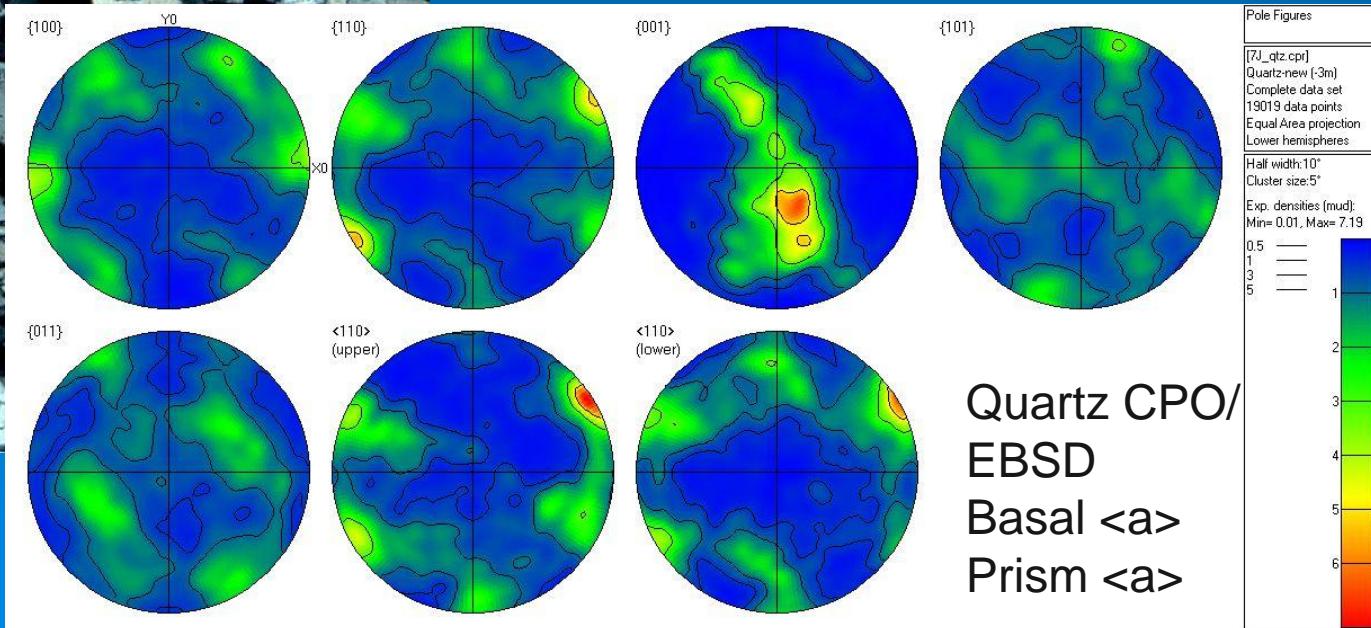
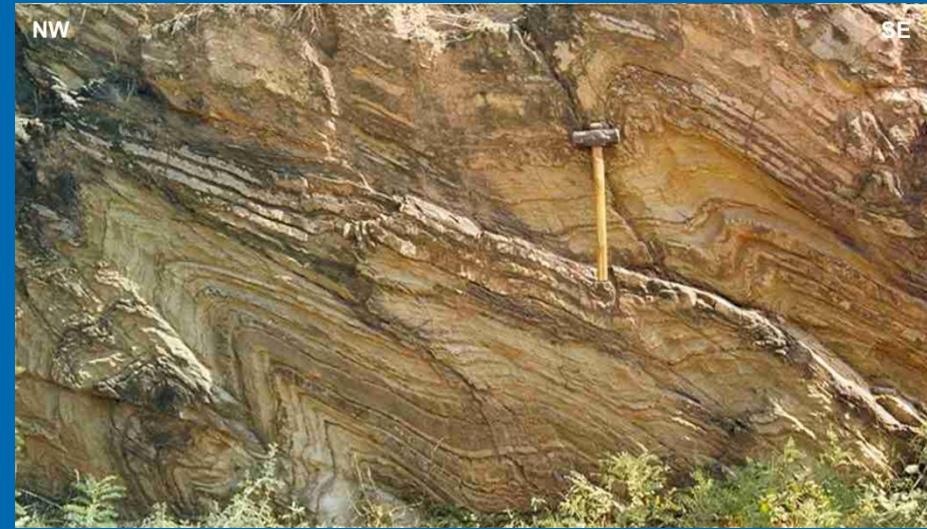
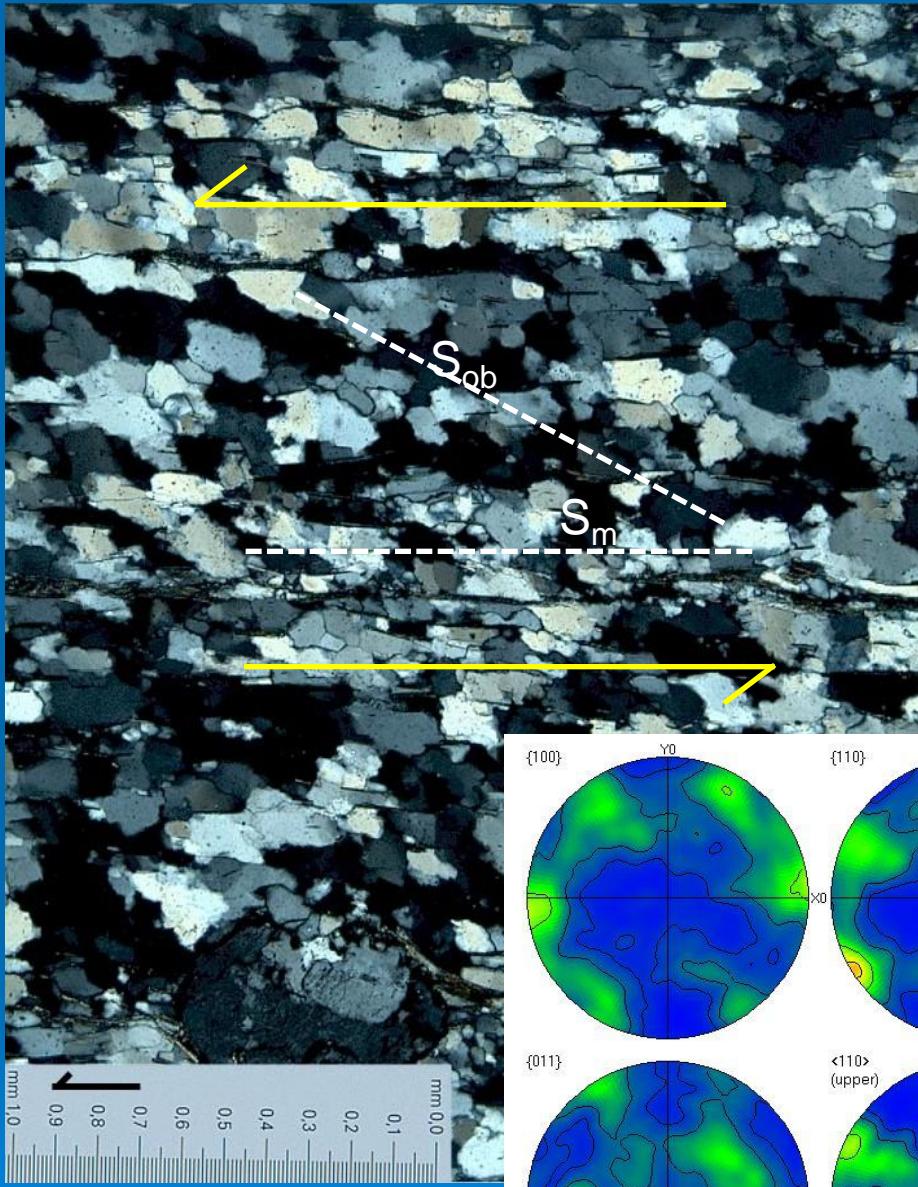


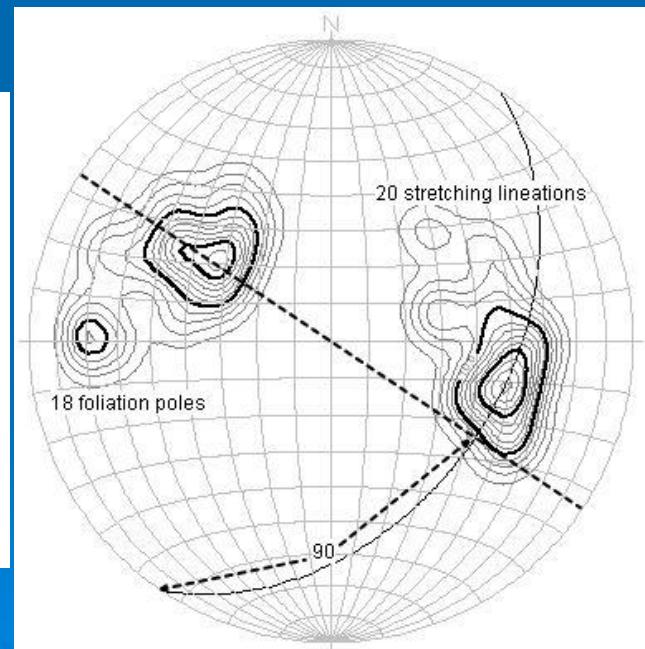
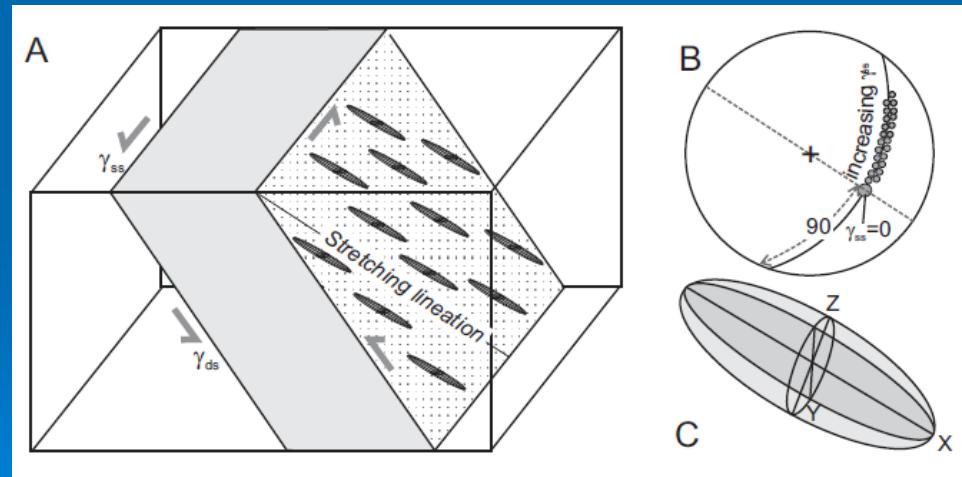
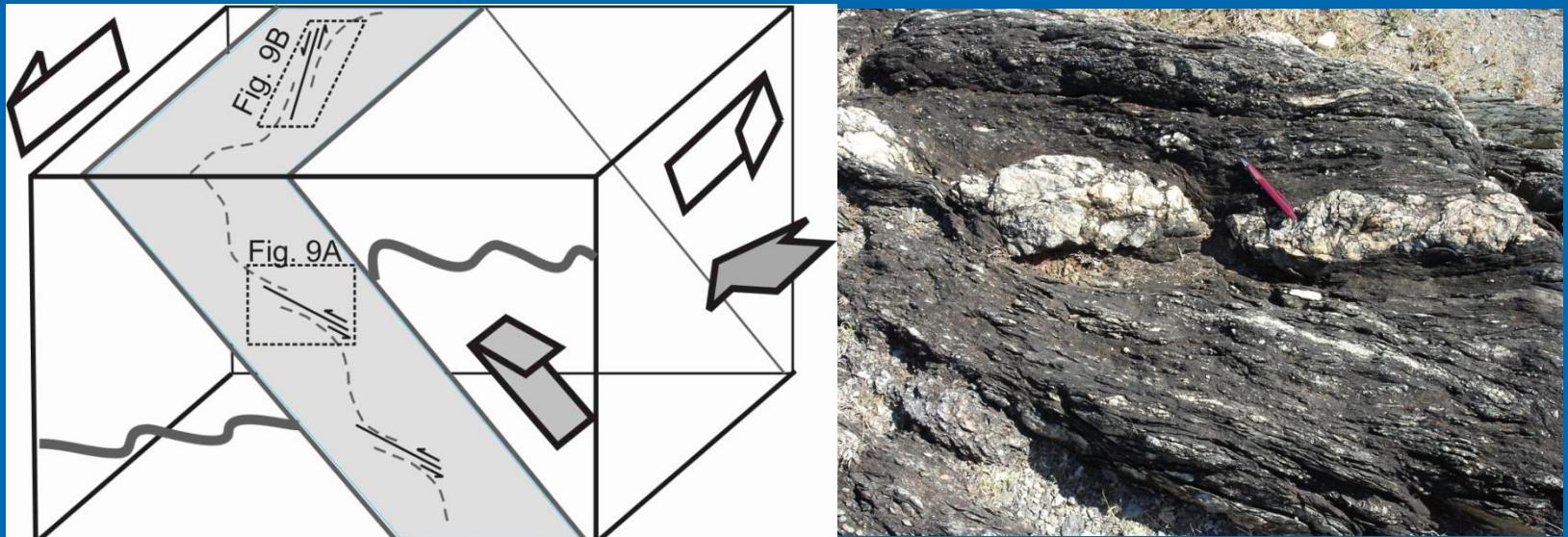
Vellikonda thrust front (S R Puram)



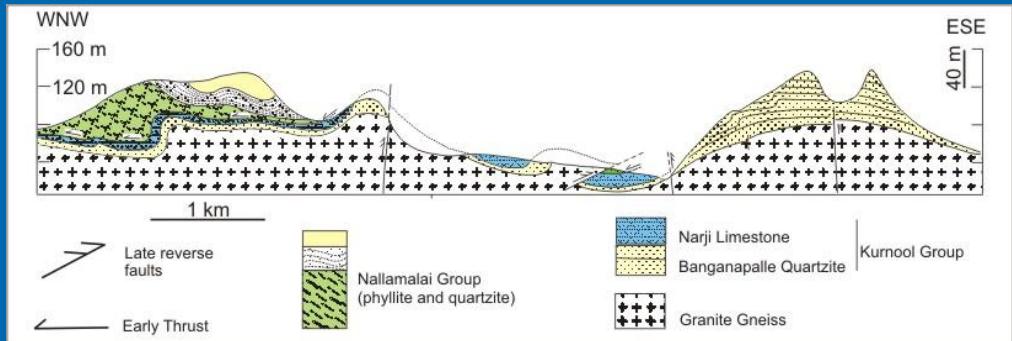
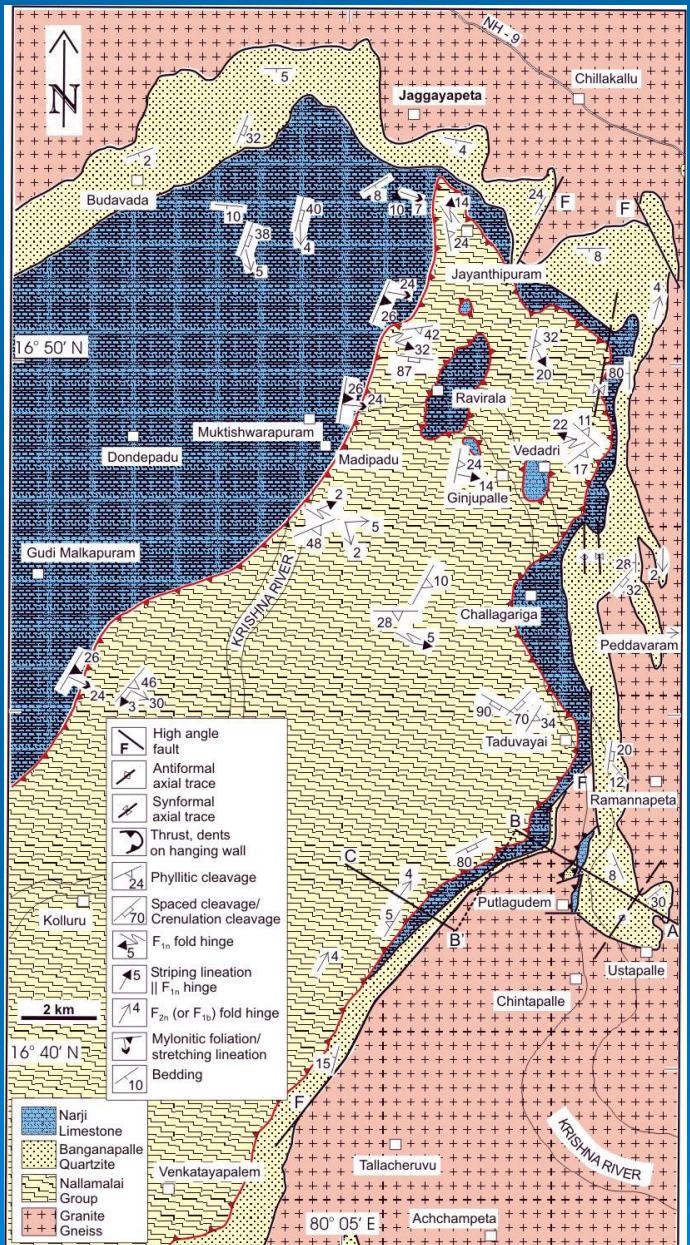
VELLIKONDA THRUST FRONT (NORTH)



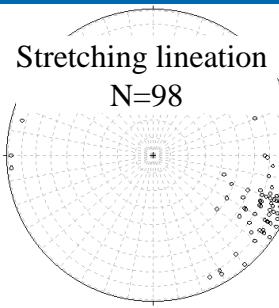
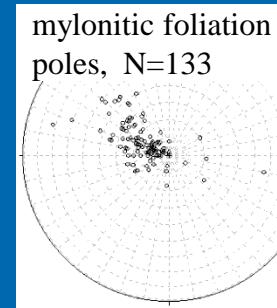
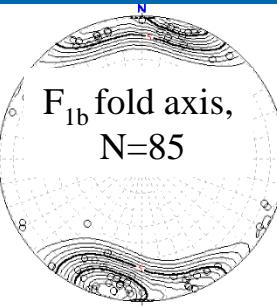
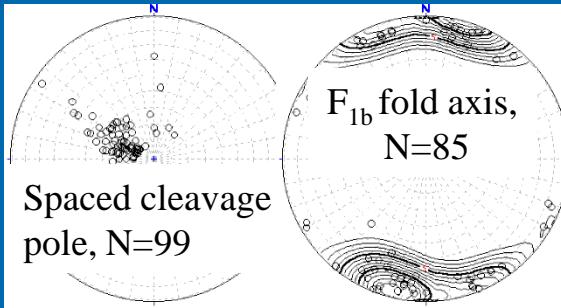




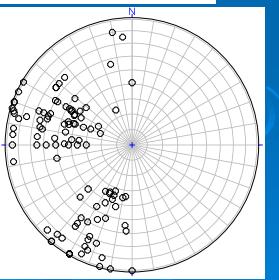
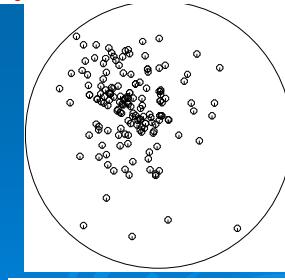
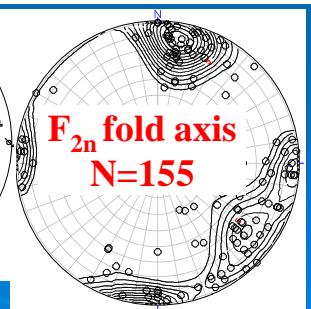
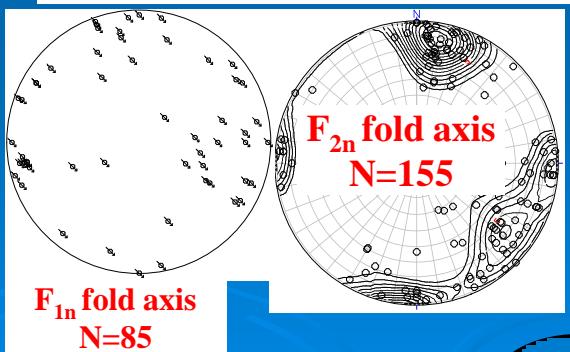
Inclined transpression along Vellikonda thrust zone



<<<< Kurnool Group structures >>>>

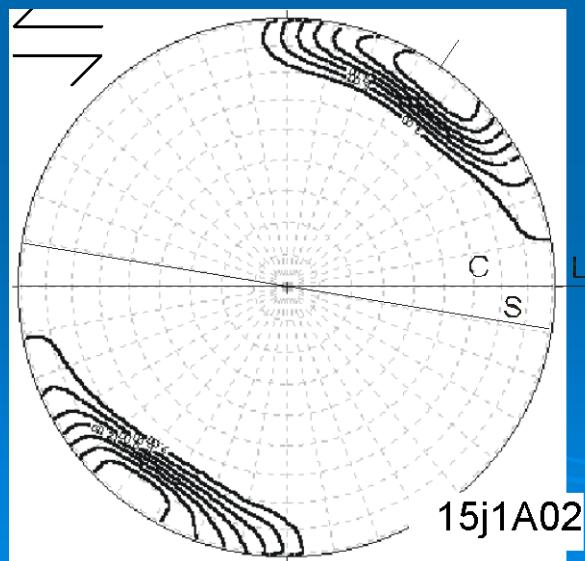
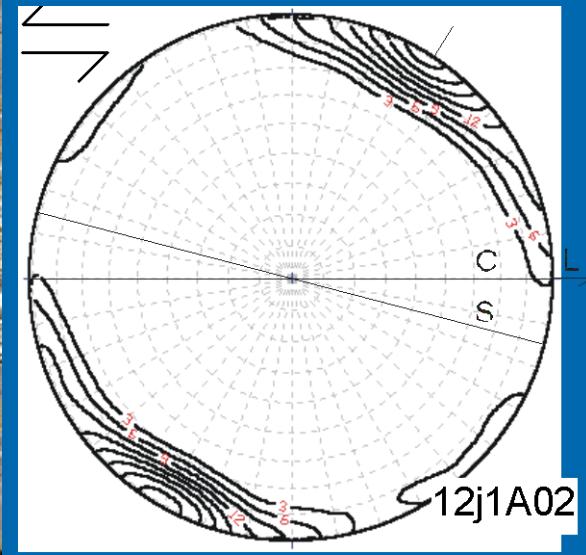


<<<< Nallamalai Group structures >>>>



Palnad klippe, Jaggayapeta

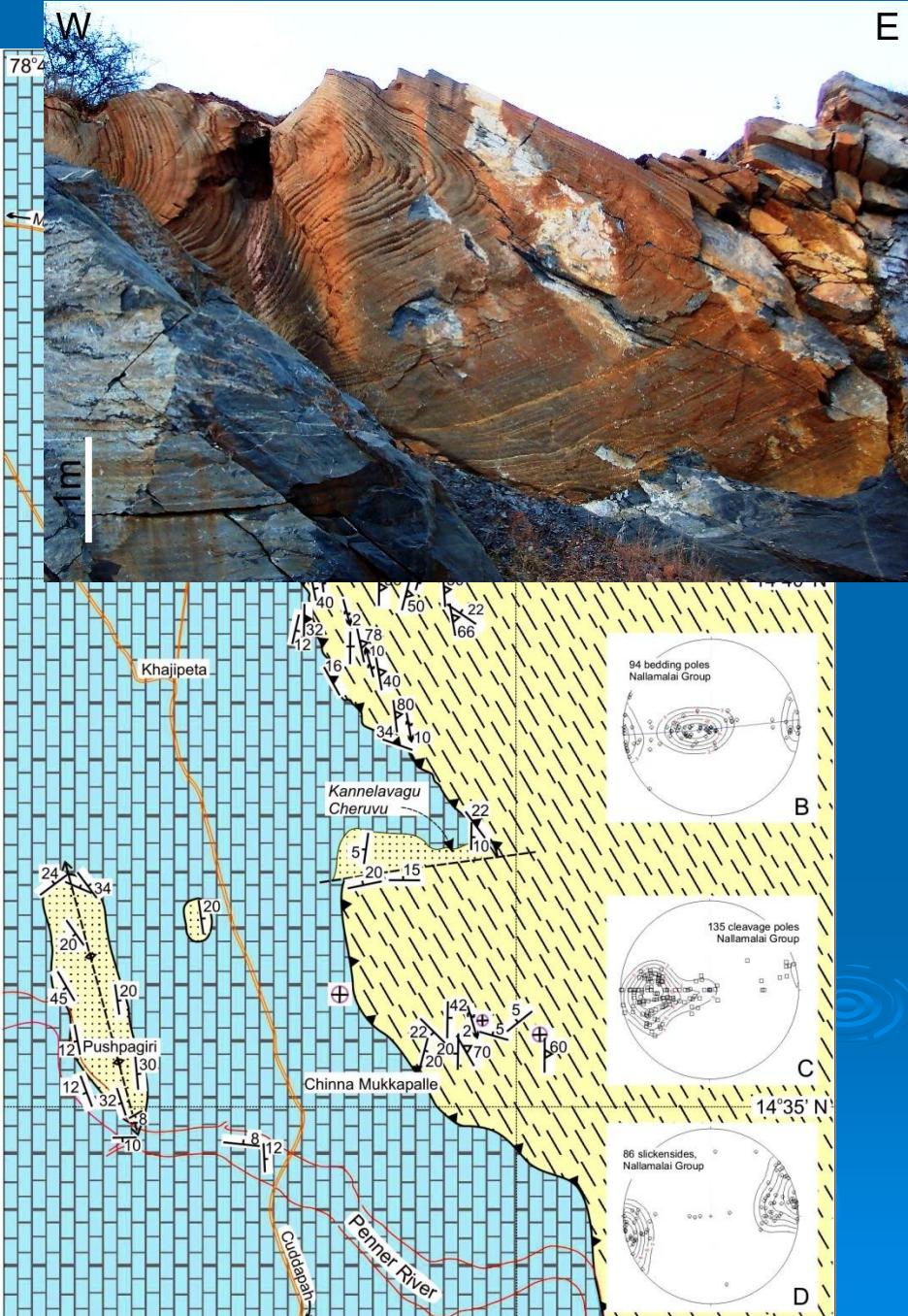
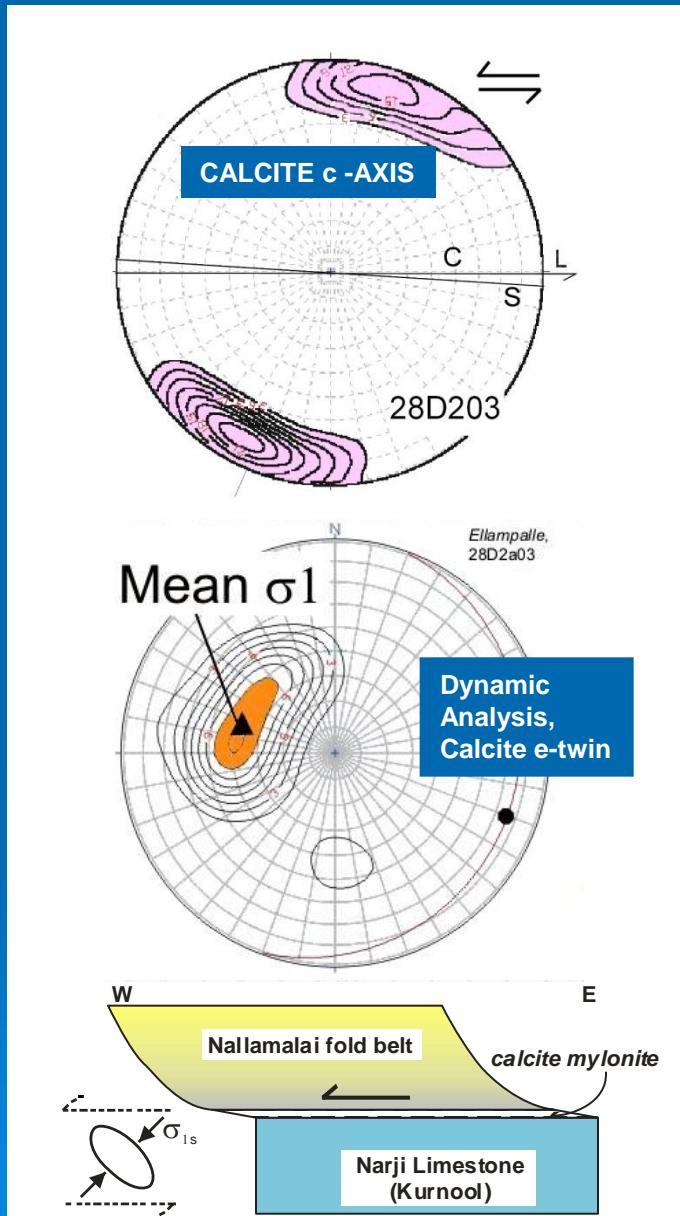
Saha & Chakraborty, 2003



a

**Palnad klippe
Calcite mylonite
& recrystallized
grain CPO**

Western boundary thrust, NFB (Maidukuru thrust)

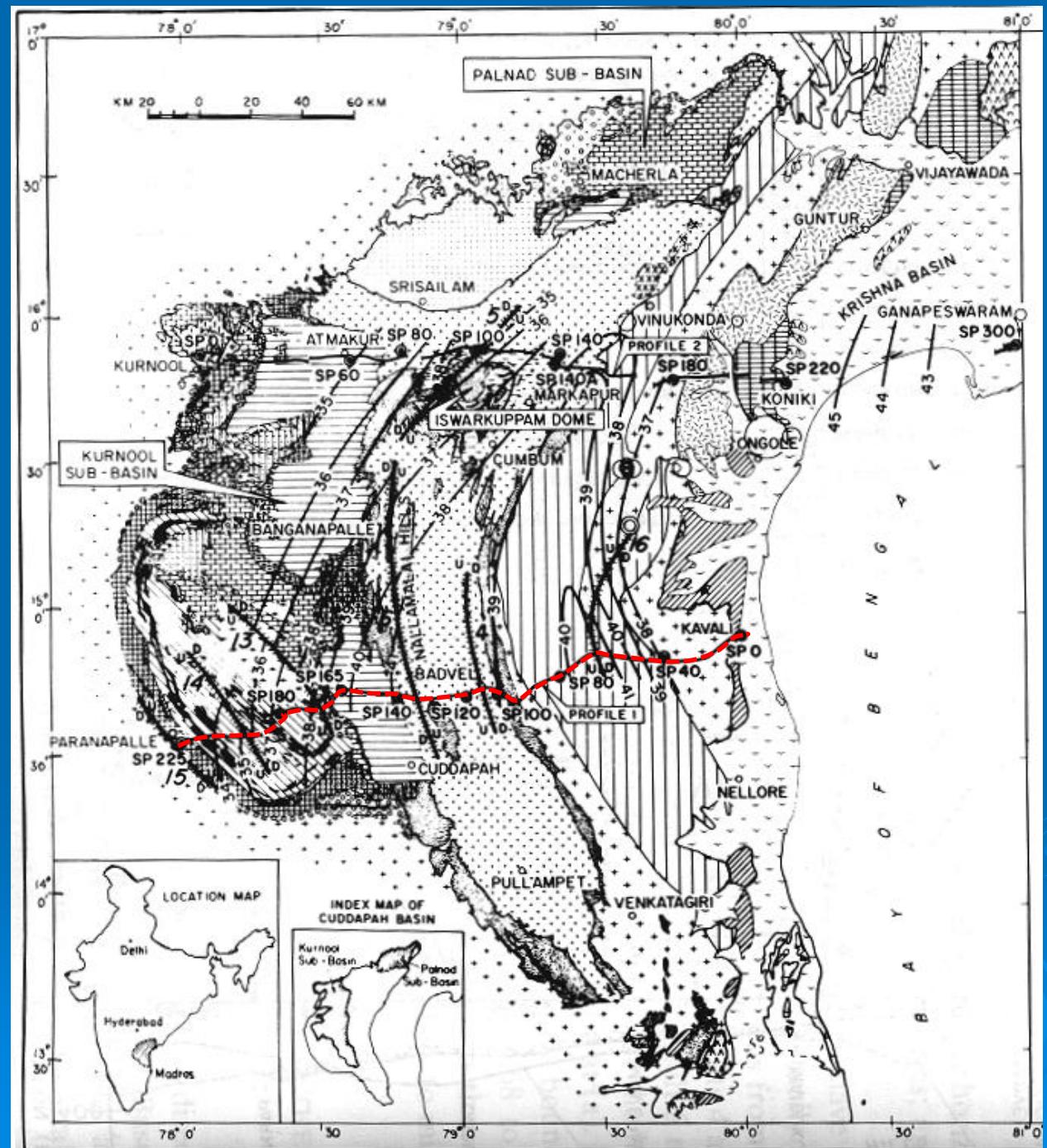


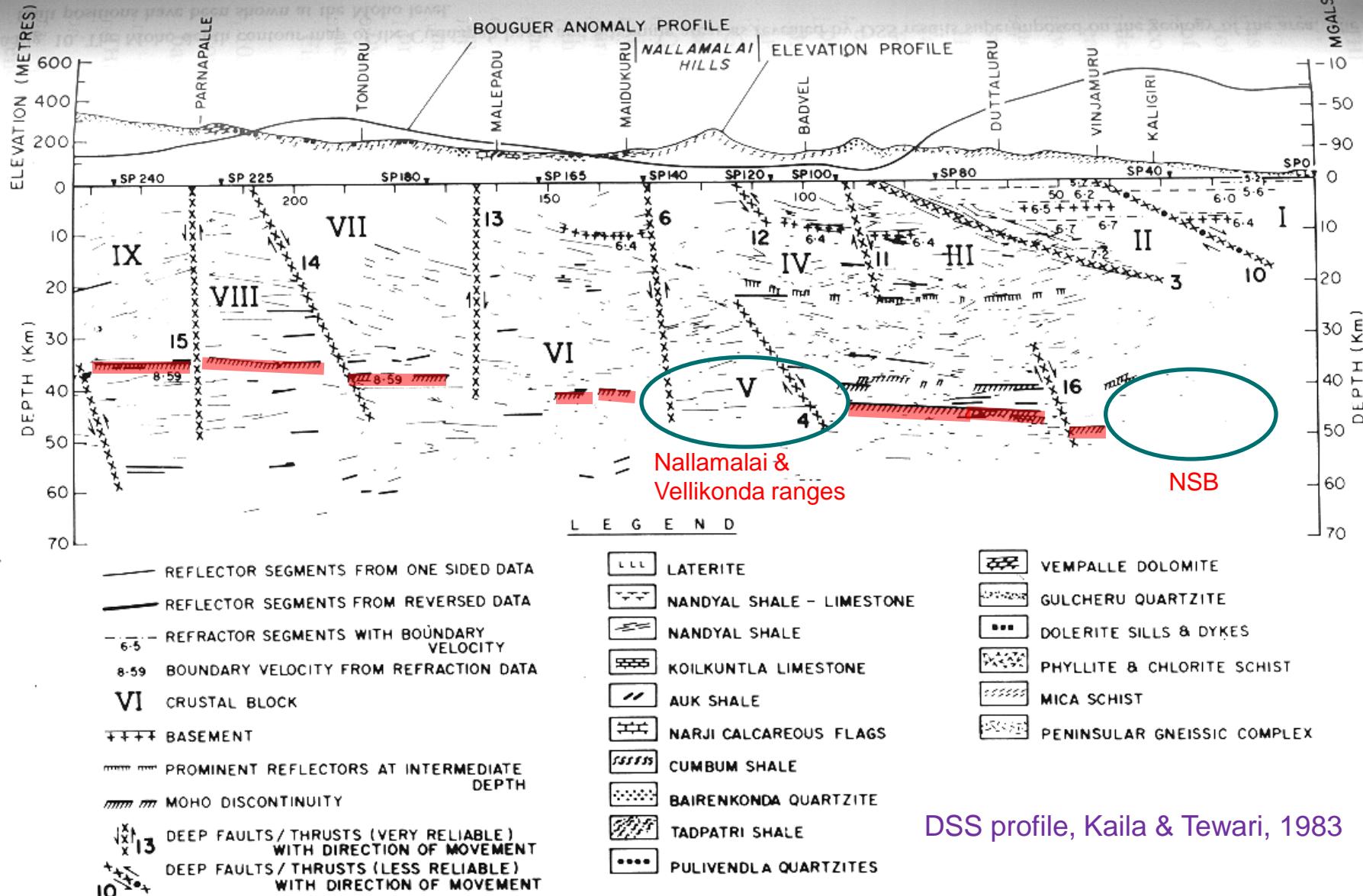
NFB boundary thrusts & CPO

- Vellikonda thrust front is associated with strong asymmetric quartz c-axis fabric.
- Westward thrust transport of NSB over NFB.
- Age of syntectonic granites suggests c. 1600 Ma convergence and mid- to lower crustal deformation.
- Strong asymmetric calcite c-axis fabric in Kurnool rocks below Palnad klippe and Maidukuru thrust in the western NFB.
- Similar calcite mylonite fabric in North NFB indicating low-T reactivation
- Late low-T upper crustal deformation in late Neoproterozoic, possibly PanAfrican

DSS Profile

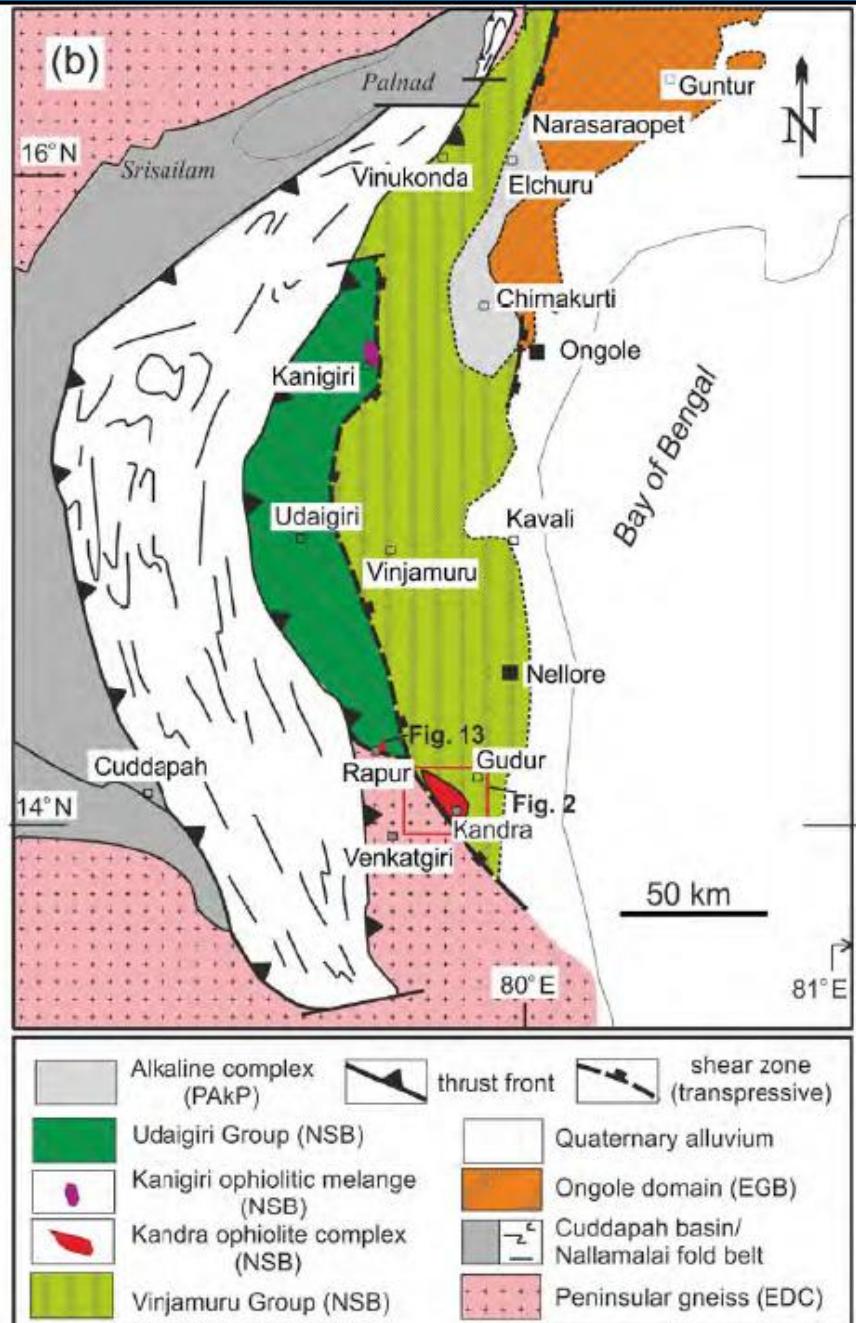
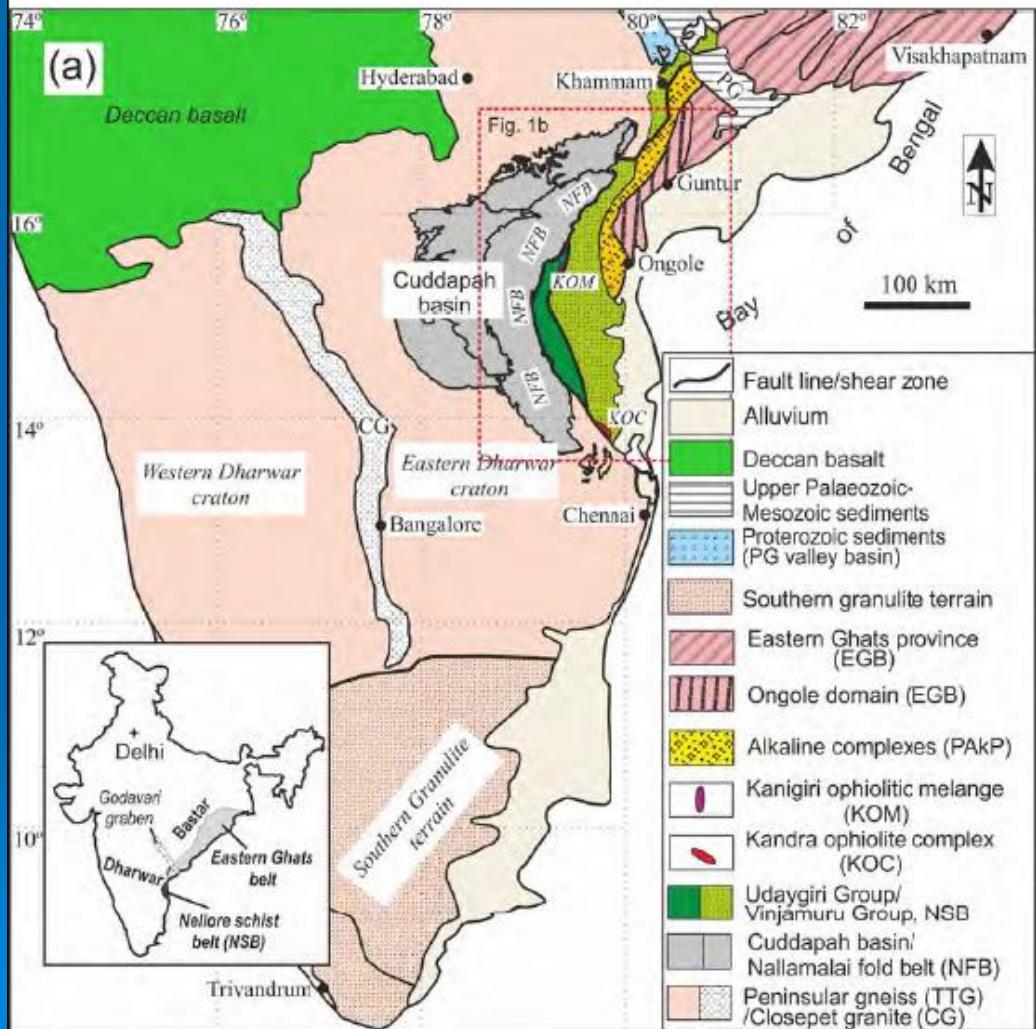
- ❖ Parnapalli-Kavali sector
- ❖ Alampur-Koniki-Ganapeswaram sector
- ❖ Kaila & Tiwari, 1983





DSS profile, Kaila & Tewari, 1983

Nellore Schist belt & ophiolitic domains

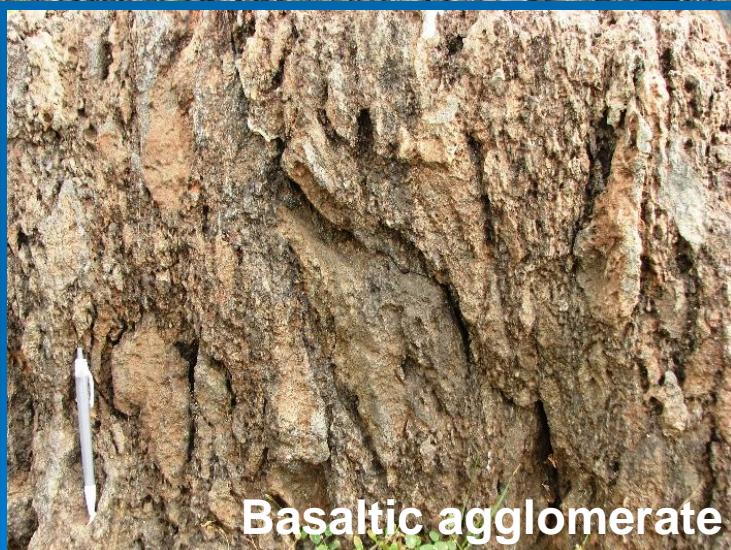
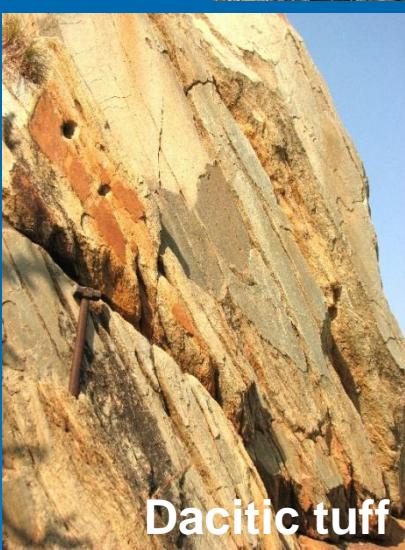




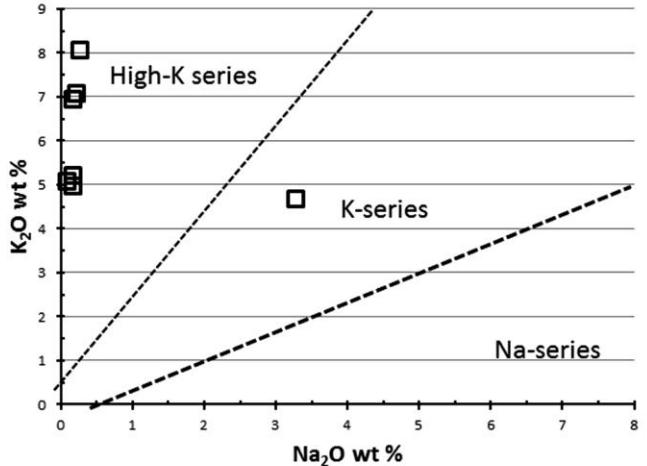
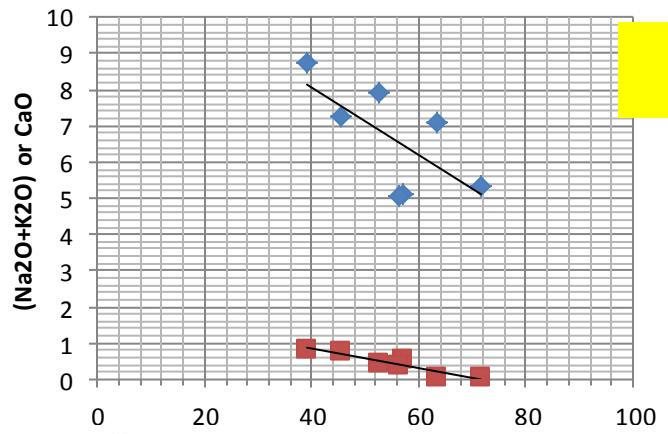
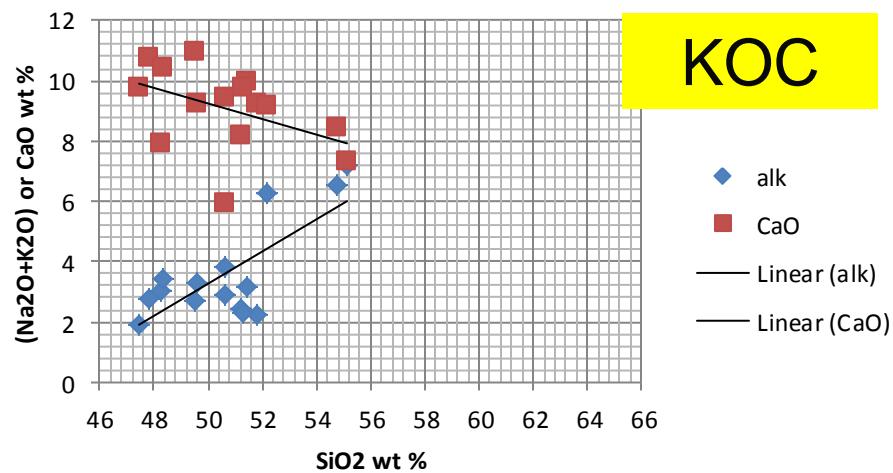
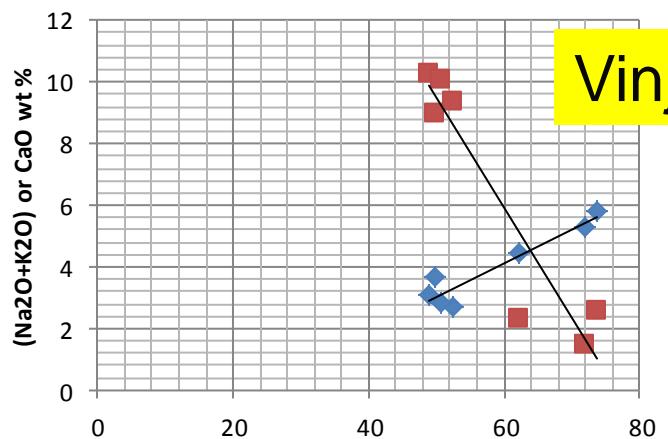
Vinjamuru Group



Vinjamuru Group contd.

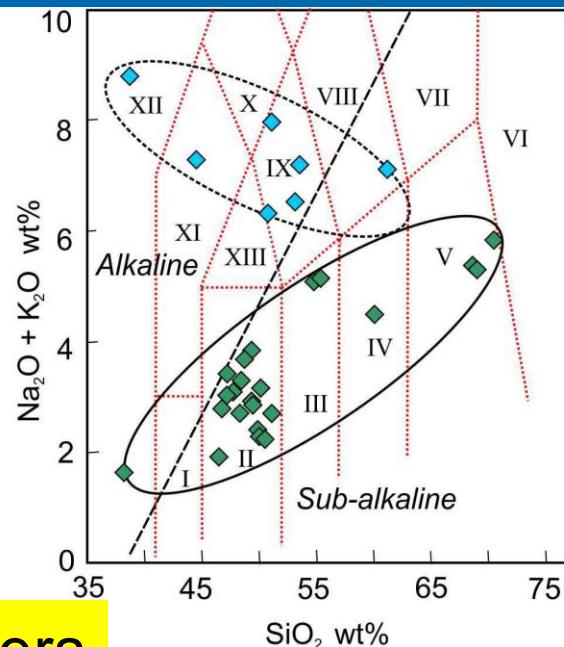


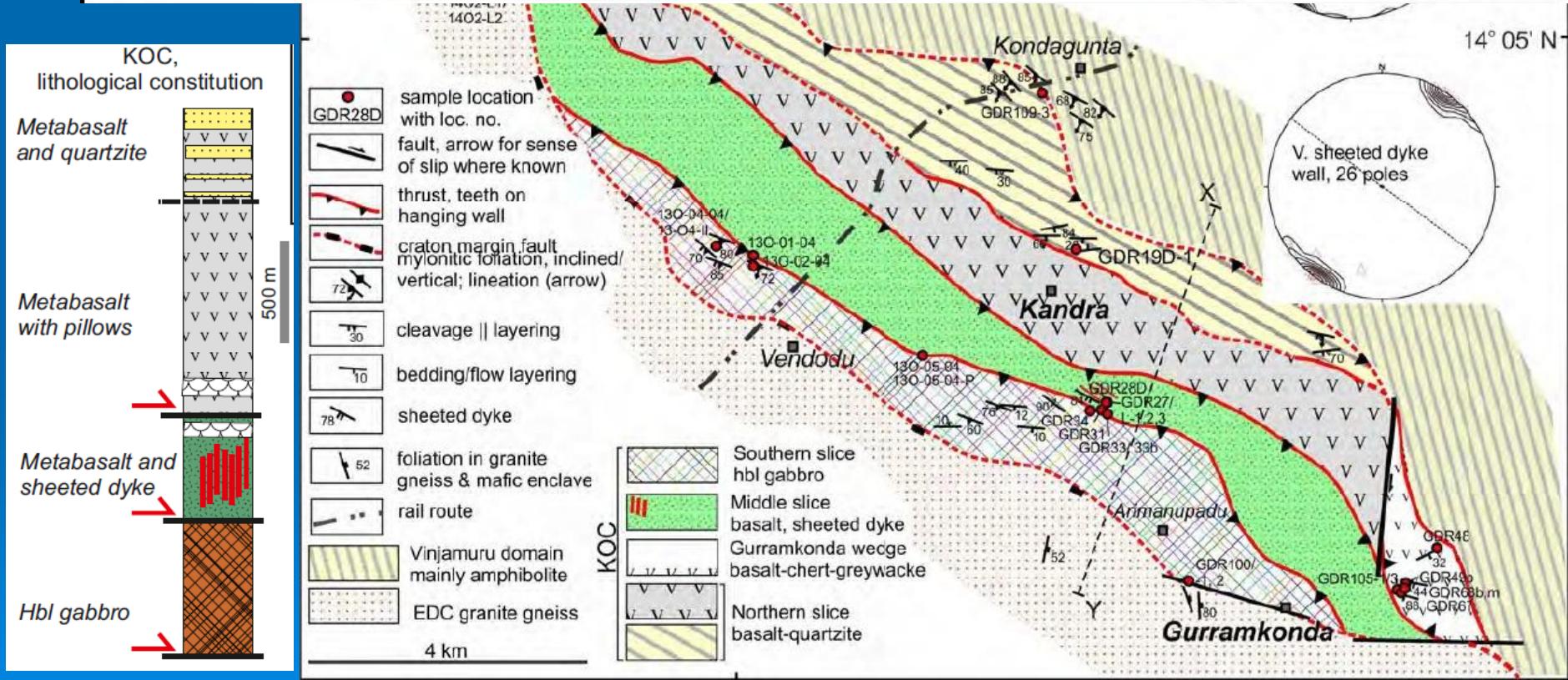
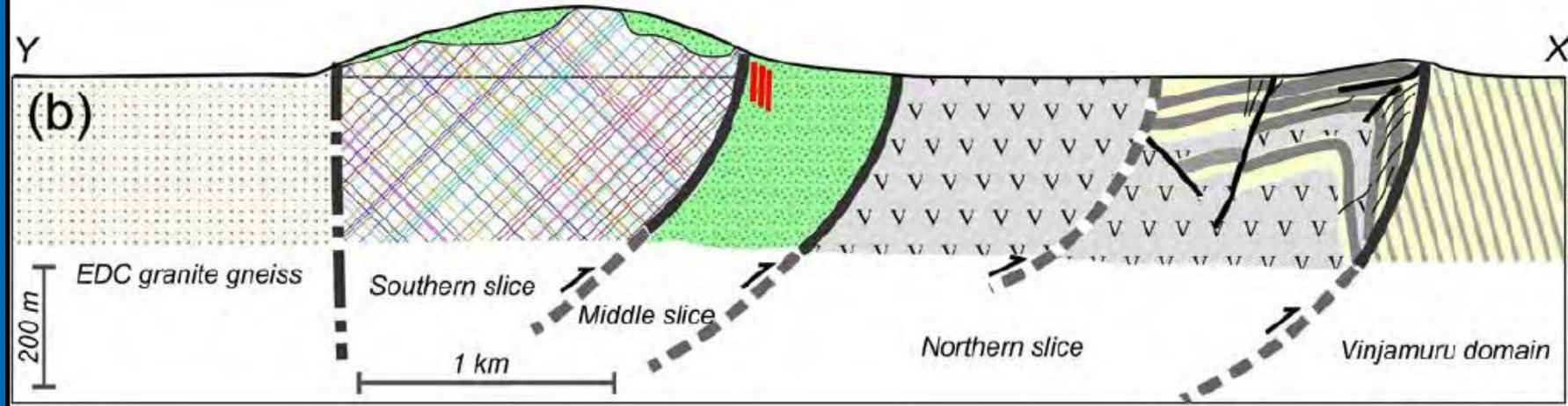
Kanigiri ophiolitic melange (c. 1334 Ma)

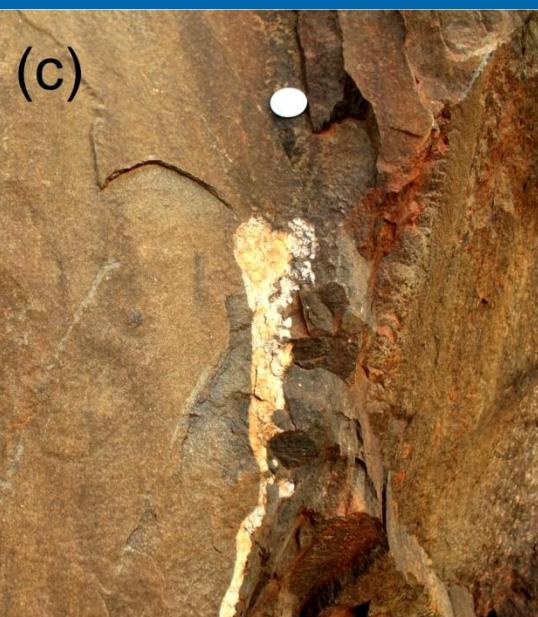


I. Picrobasalt
 II. Basalt
 III. Basaltic andesite
 IV. Andesite
 V. Dacite
 VI. Rhyolite
 VII. Trachydacite
 VIII. Trachyandesite
 IX. Basaltic trachyandesite
 X. Phono Tephrite
 XI. Tephrite Basanite
 XII. Foidite
 XIII. Trachybasalt

KOM vs others

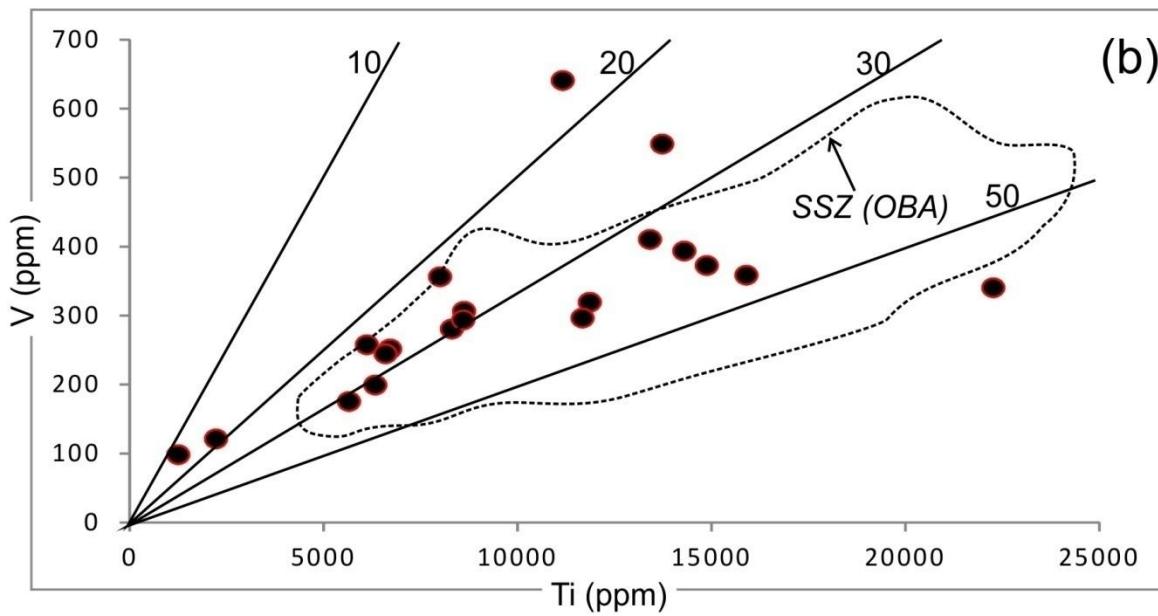
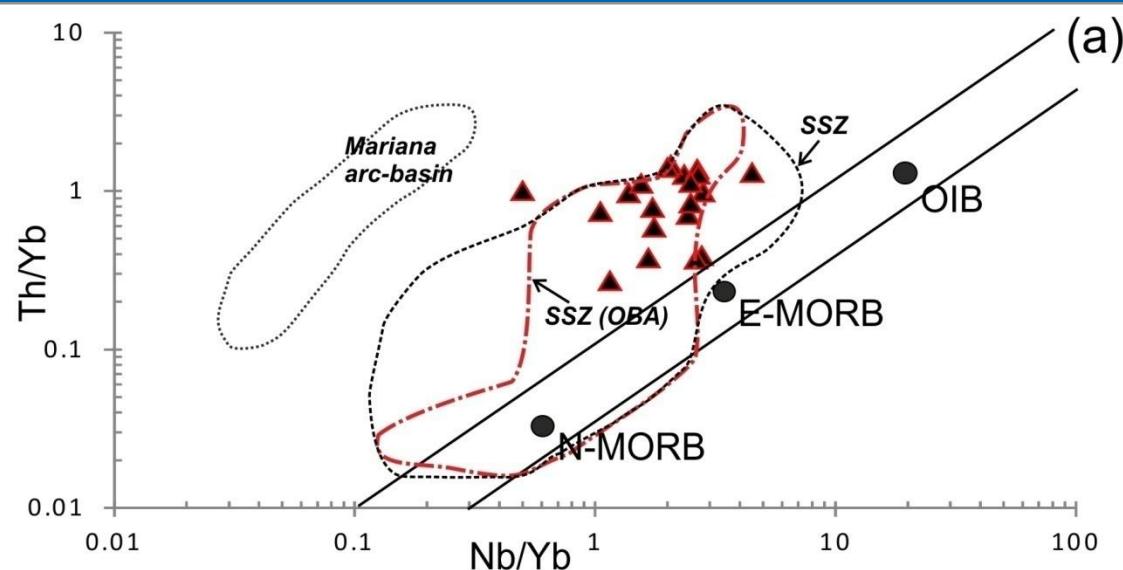






KOC geochemistry

Overlaps with supra-subduction zone oceanic back-arc type ophiolite (Dilek et al.)



NSB & global tectonic events

(b) collision

Condie 1990

TTG slivers 2484+/-5 Ma

areas: south of Rapur, Vendodu

granitoid orange, Condie & Aster 2010

(d) supercontinent assembly (orange)
and breakup (blue), Bradley 2011

**(a) Nellore schist belt,
southern India**

Pegmatites, granites of Nellore mica belt

Udaigiri Group: meta-arkose, quartzite, greenschist facies metapelitic with thin metabasalt; type areas: Udaigiri & Rapur

Kanigiri granite, 1120+/-25 Ma
cf. PAkP alkaline plutons

Kanigiri ophiolitic melange (KOM)
type area: Kanigiri, 1334 Ma

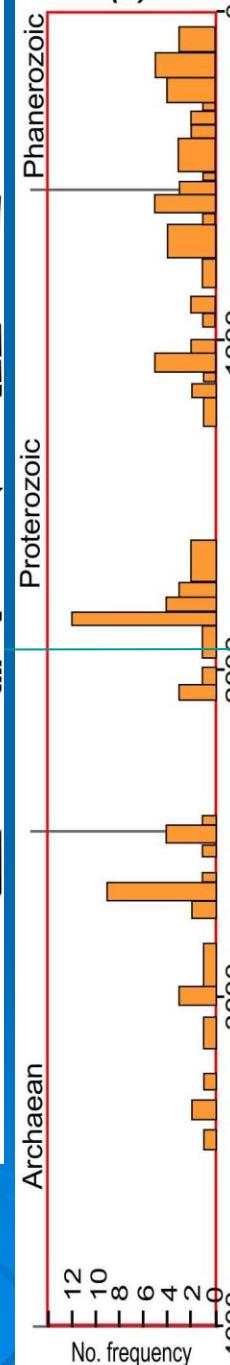
Vinukonda metagranite, 1589 Ma
migmatitic gneiss of Vinjamuru Group

Kandra ophiolitic complex (KOC):
dismembered OPS, 1900 Ma;
type area: Kandra-Gurramkonda

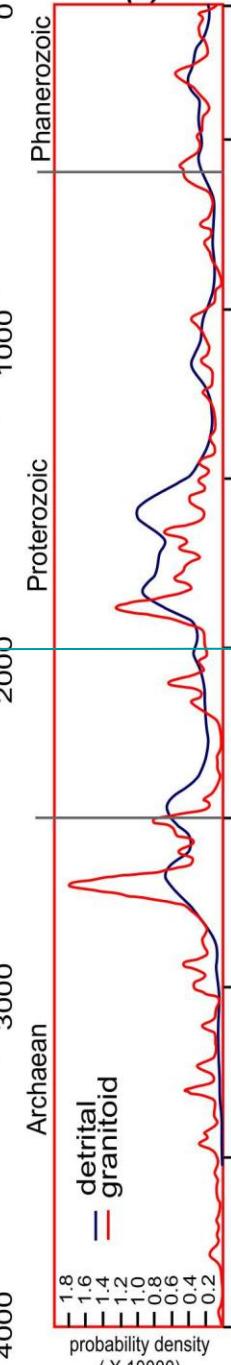
Vinjamuru Group: amphibolite facies metabasalt, thin aluminous metapelitic, metapsammite & ferruginous quartzite; type areas: Vinjamuru & Saidapuram

----- Global events -----

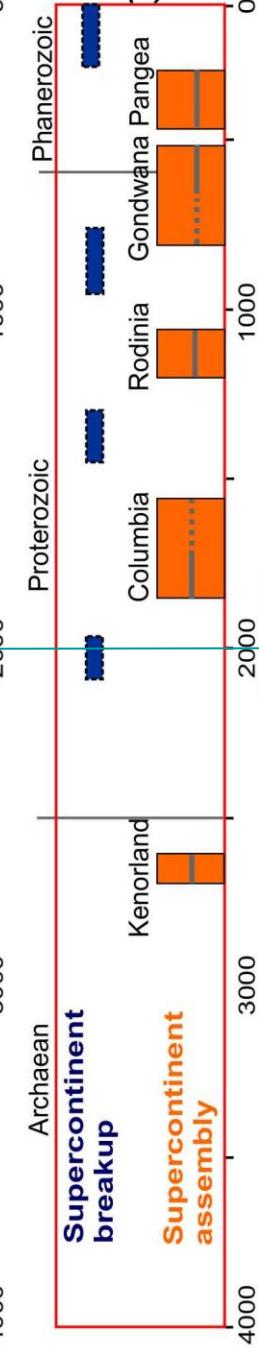
(b)



(c)

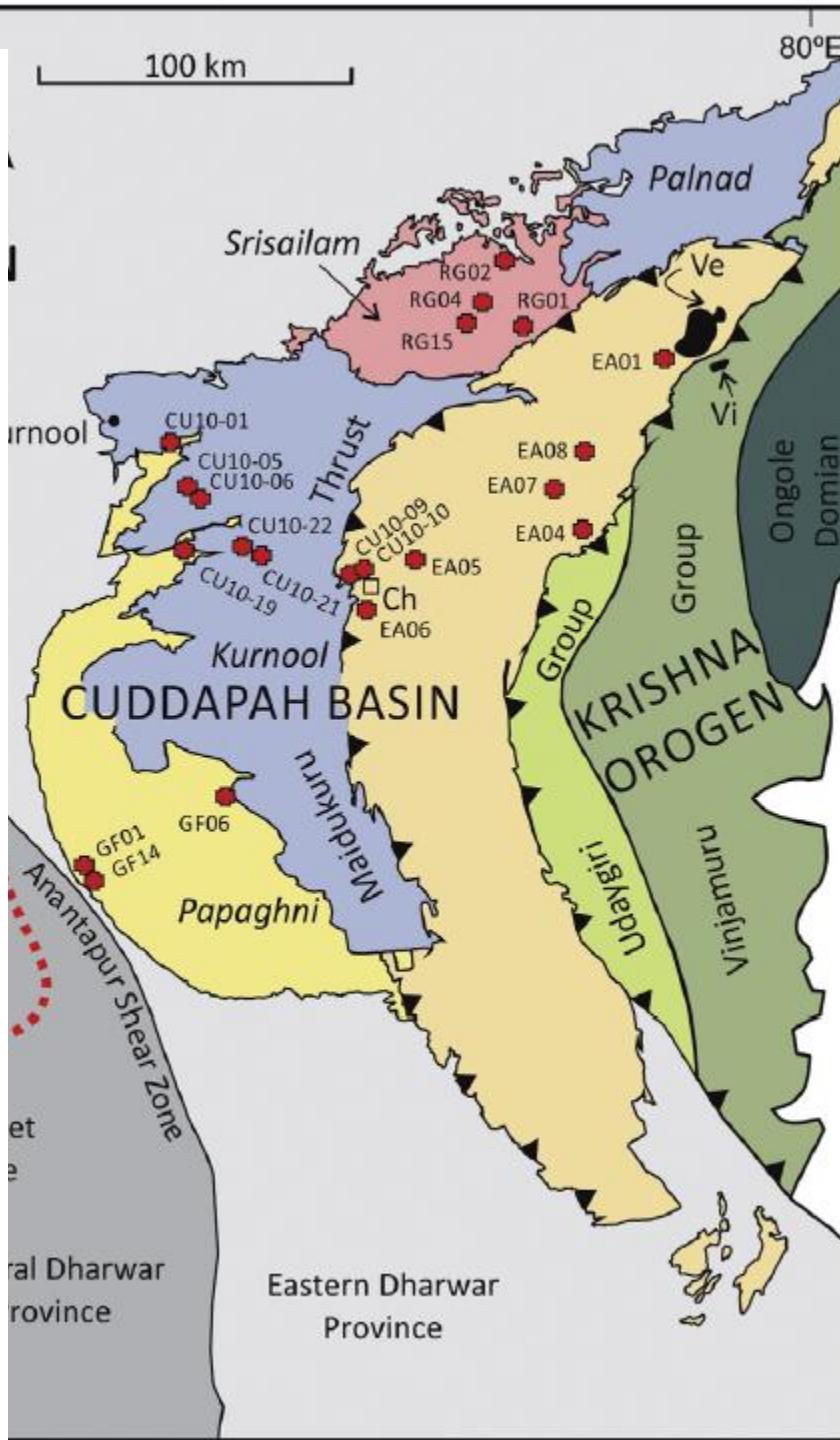
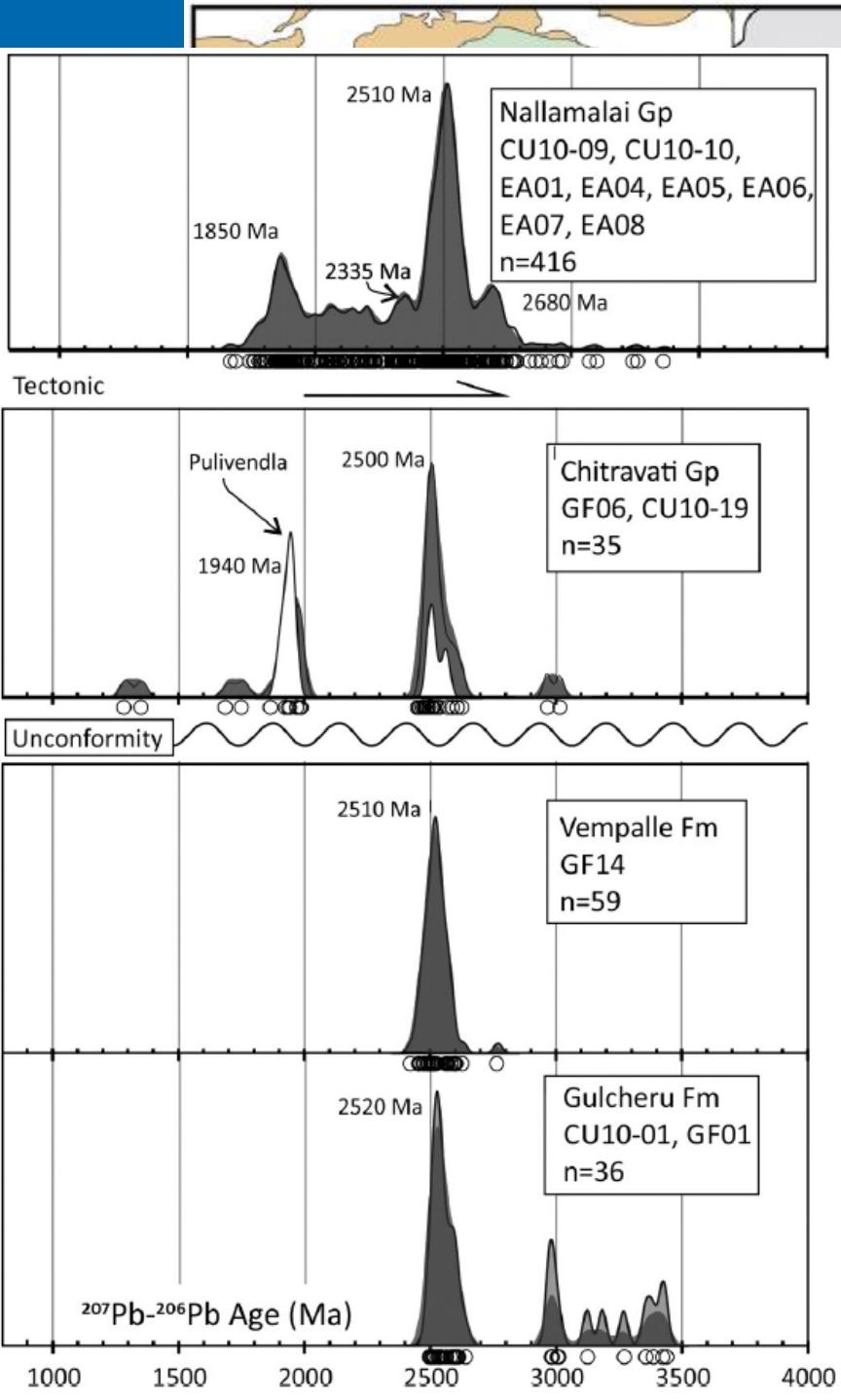


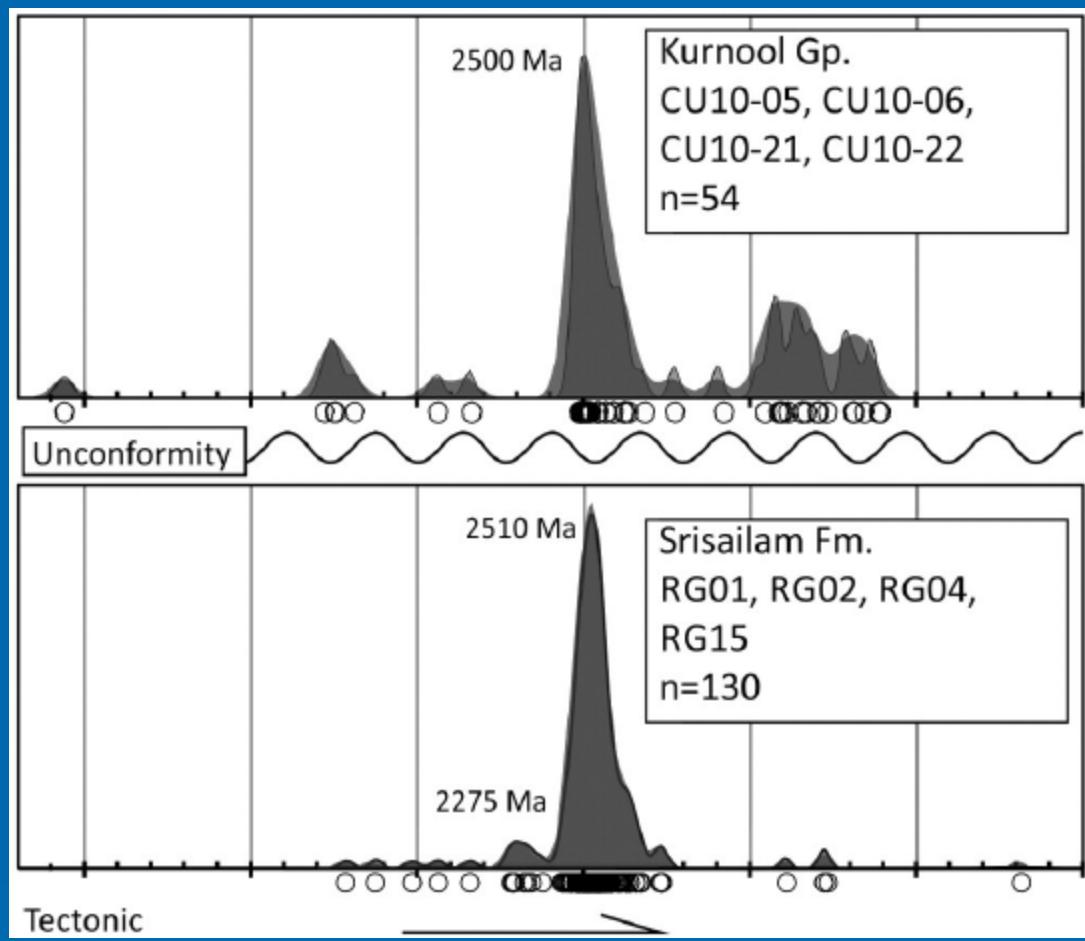
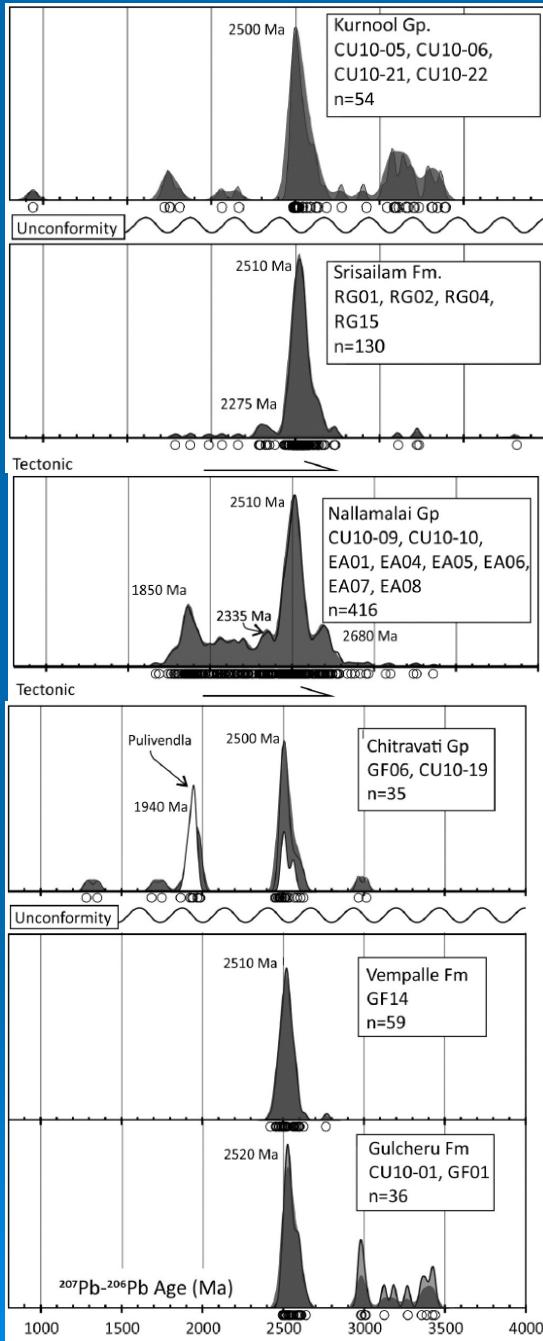
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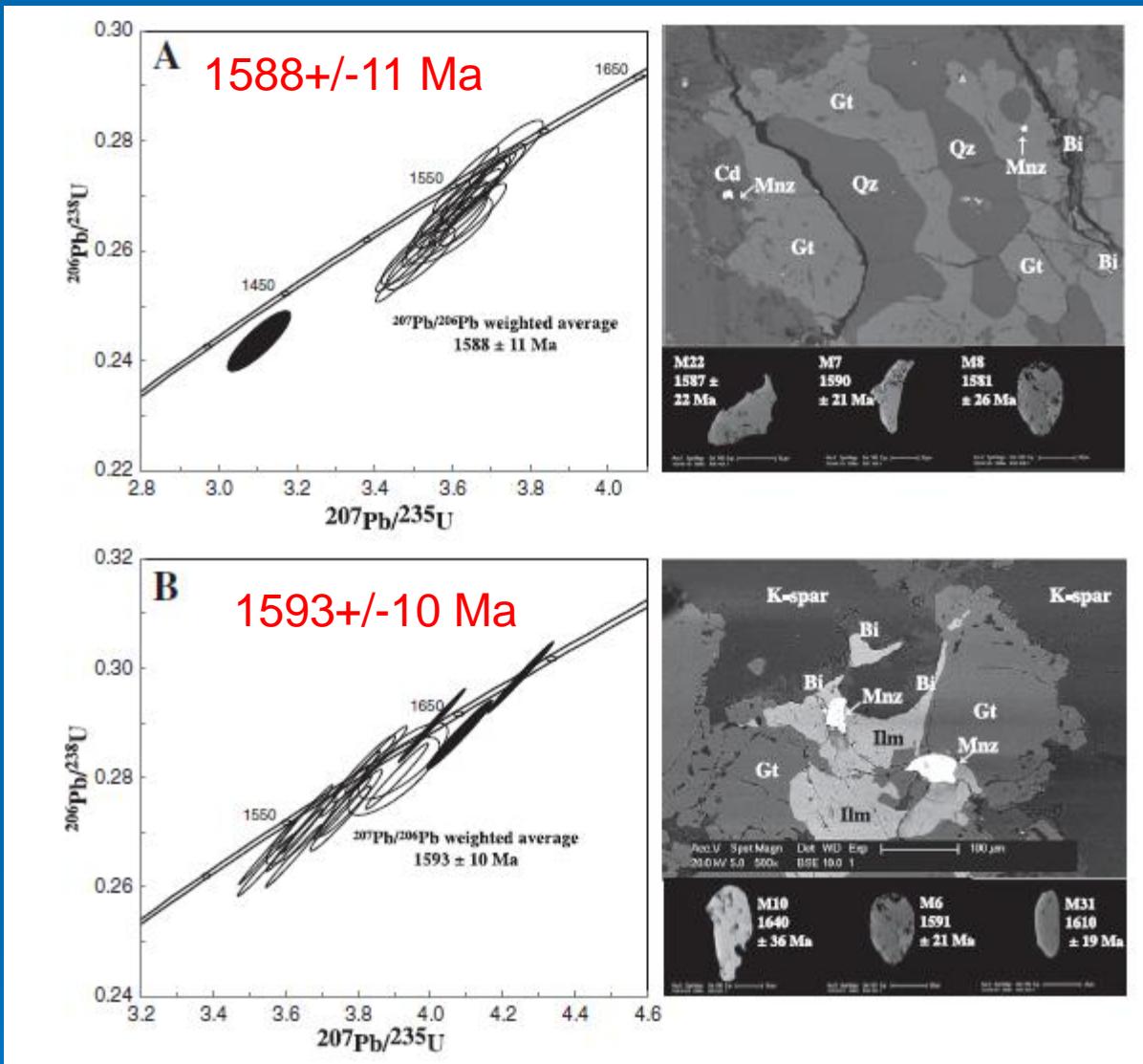


geochronologic & isotopic constraints









Monazite ages, EGB Ongole domain

Gondwana Research 26 (2014) 888–906



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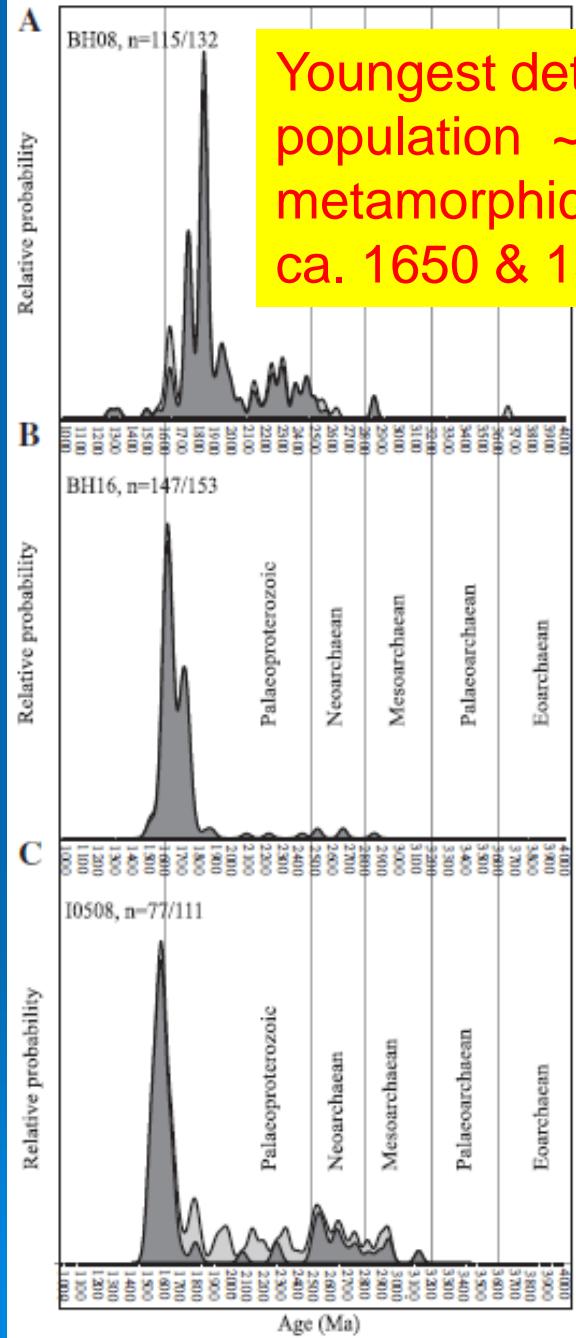
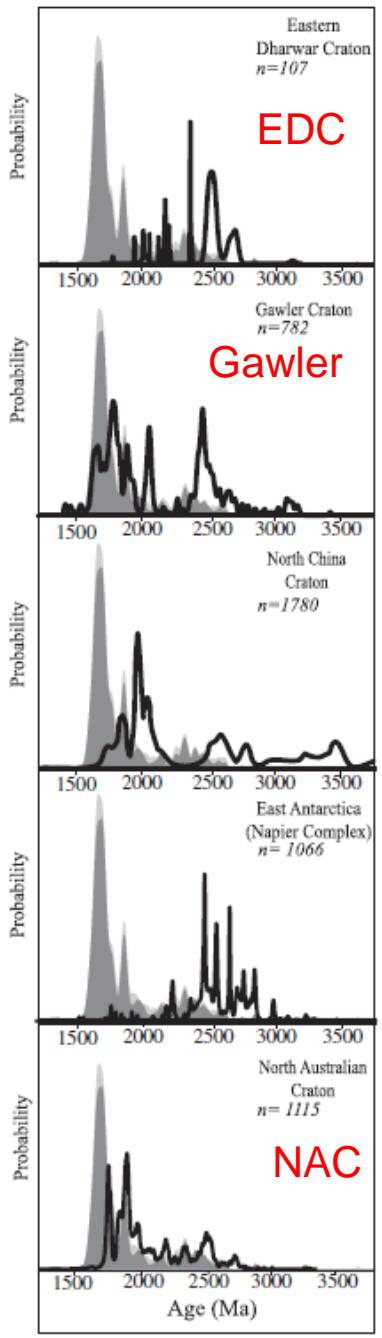
journal homepage: www.elsevier.com/locate/gr



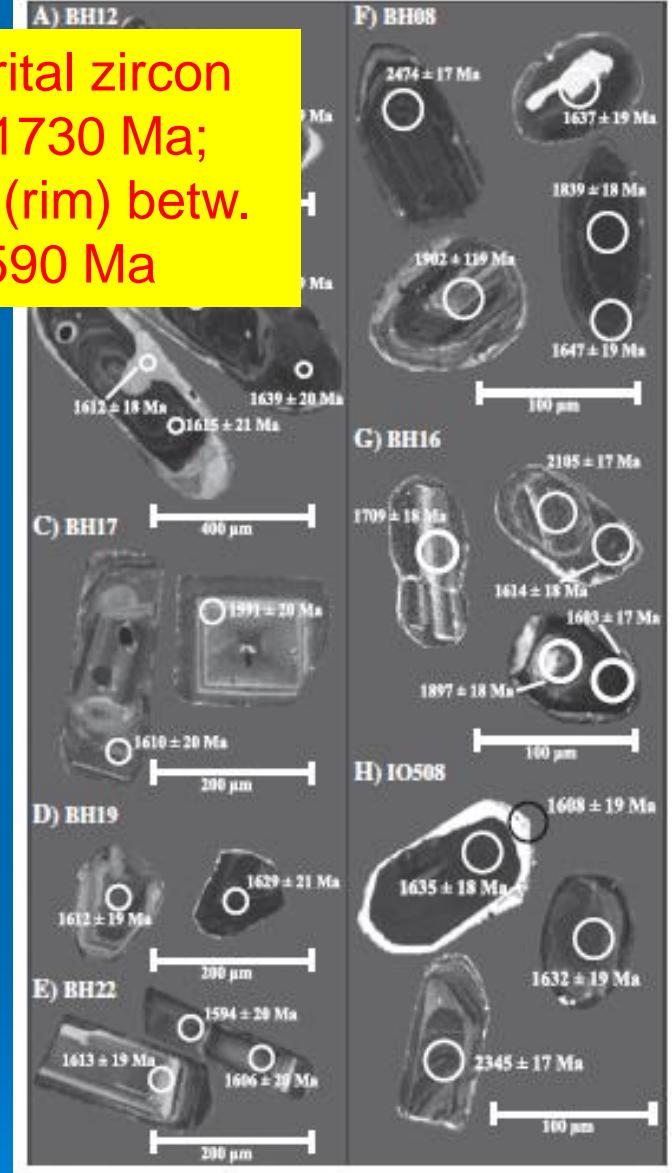
Geologically constraining India in Columbia: The age, isotopic provenance and geochemistry of the protoliths of the Ongole Domain, Southern Eastern Ghats, India

Bonnie Henderson ^{a,*}, Alan S. Collins ^b, Justin Payne ^a, Caroline Forbes ^a, Dilip Saha ^b

EGB zircon, metapelites Ongole domain



Youngest detrital zircon population ~1730 Ma;
metamorphic (rim) betw. ca. 1650 & 1590 Ma



Gondwana Research 26 (2014) 688–696



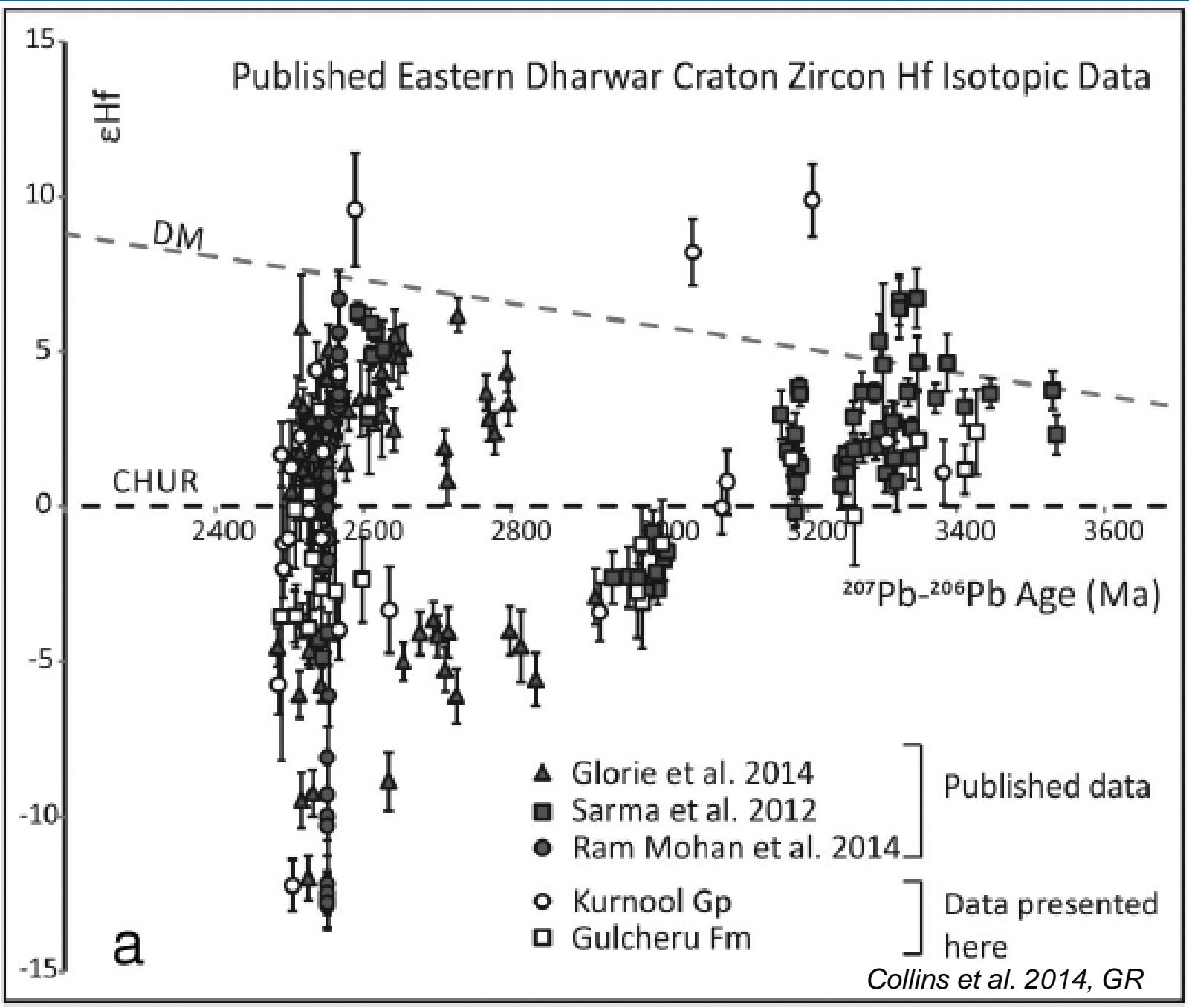
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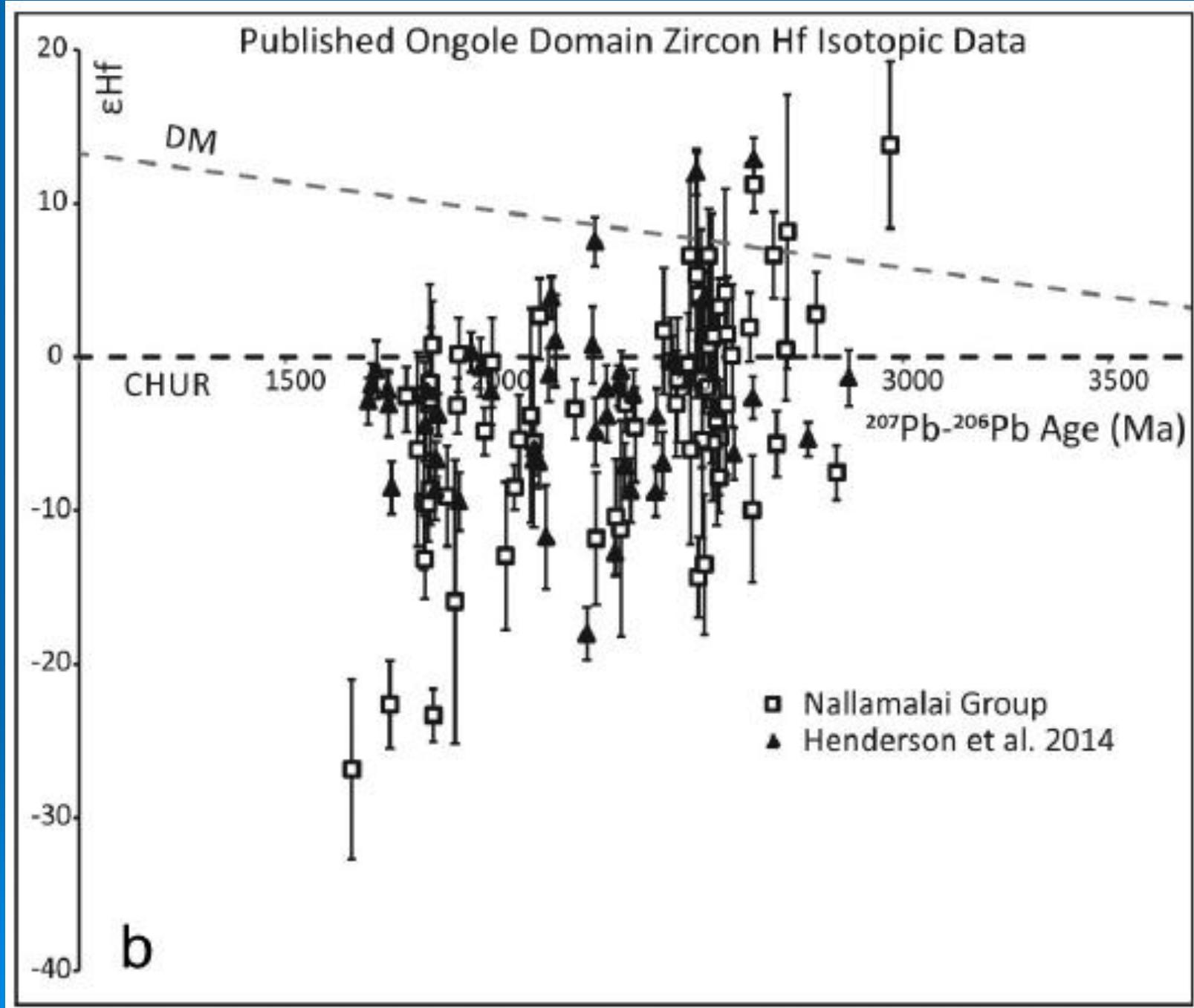
Gondwana Research

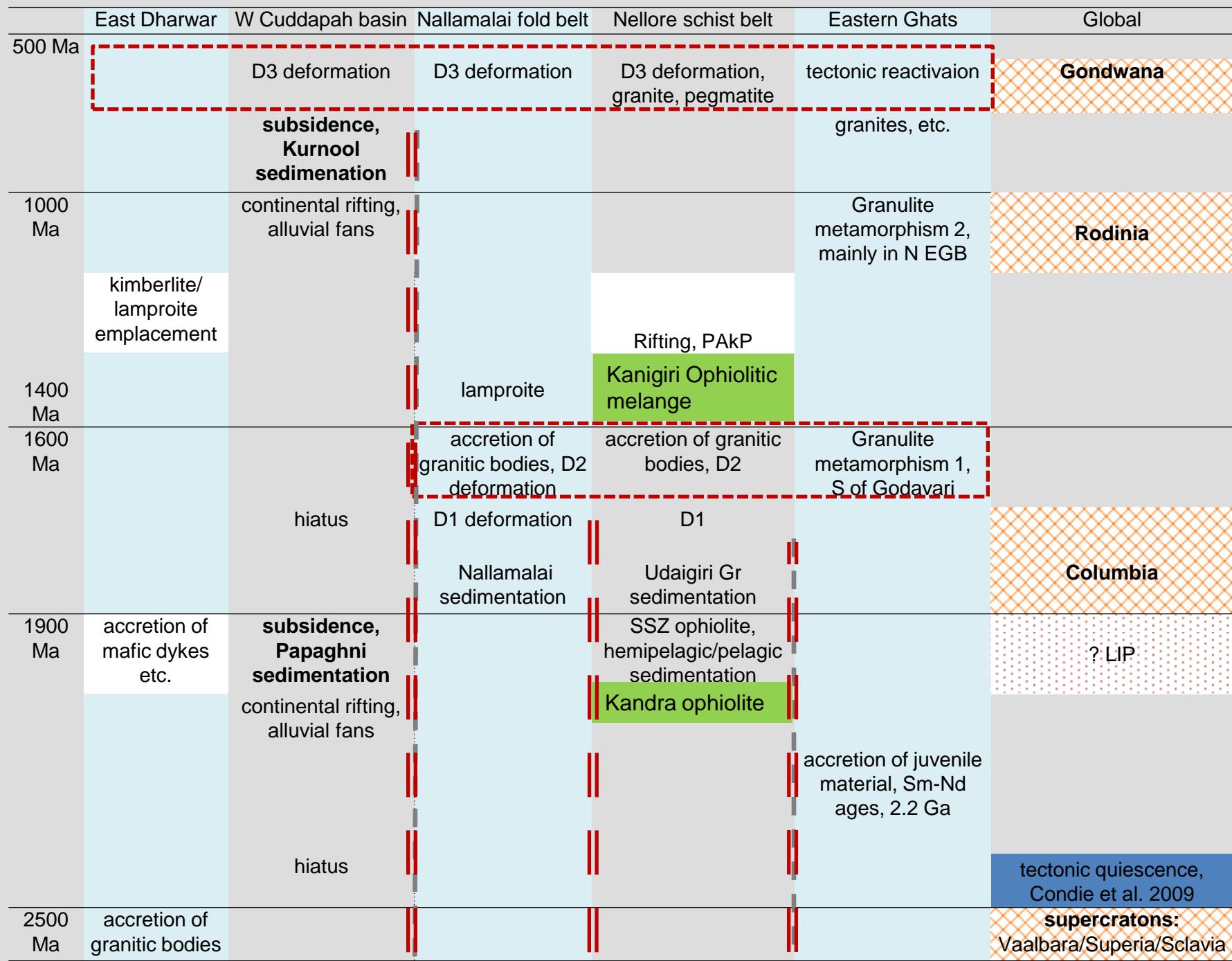
journal homepage: www.elsevier.com/locate/gr



Hf data: EDC & western Cuddapah







thank you

