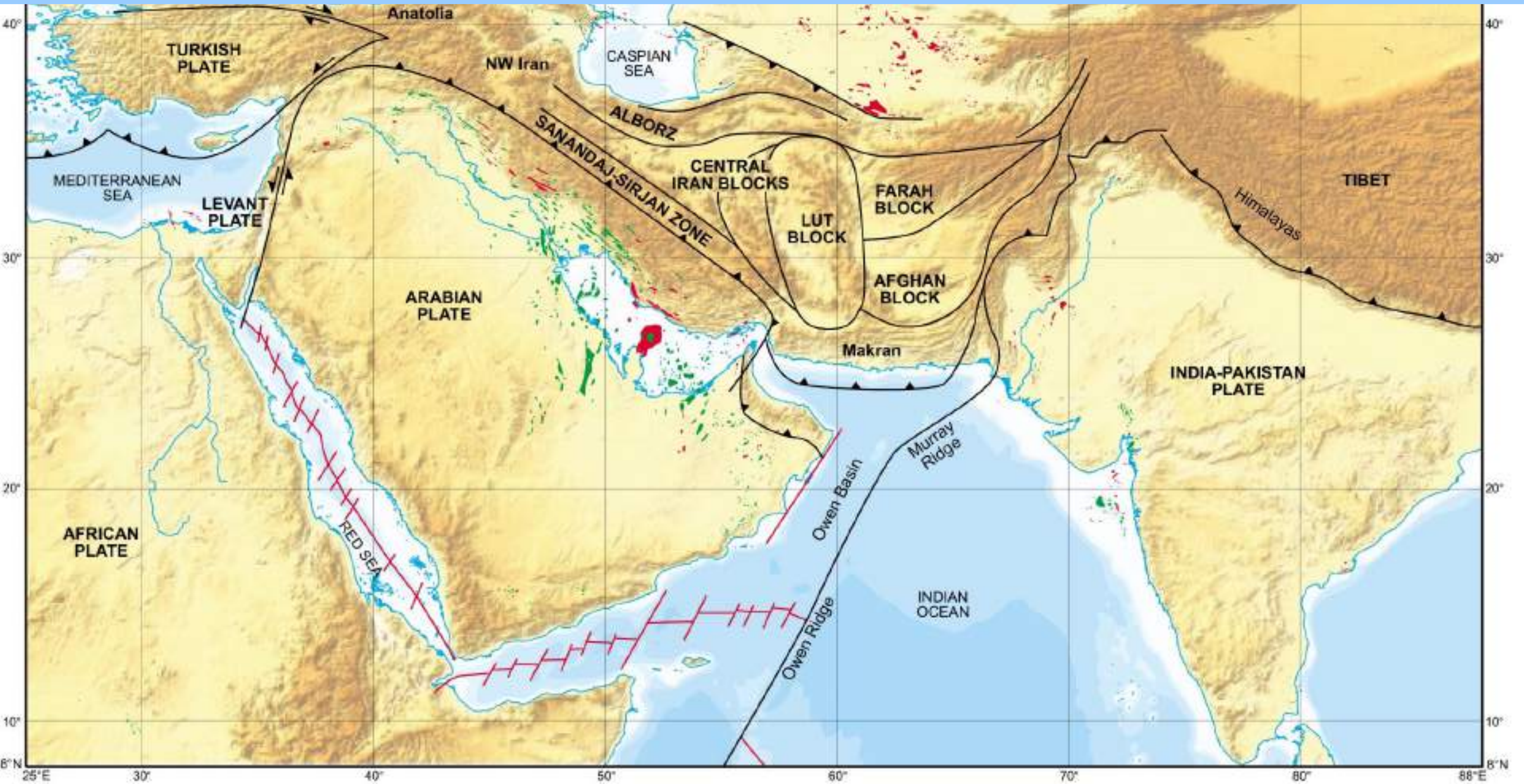
Sedimentary Cover of Saudi Arabia (Geo 385)

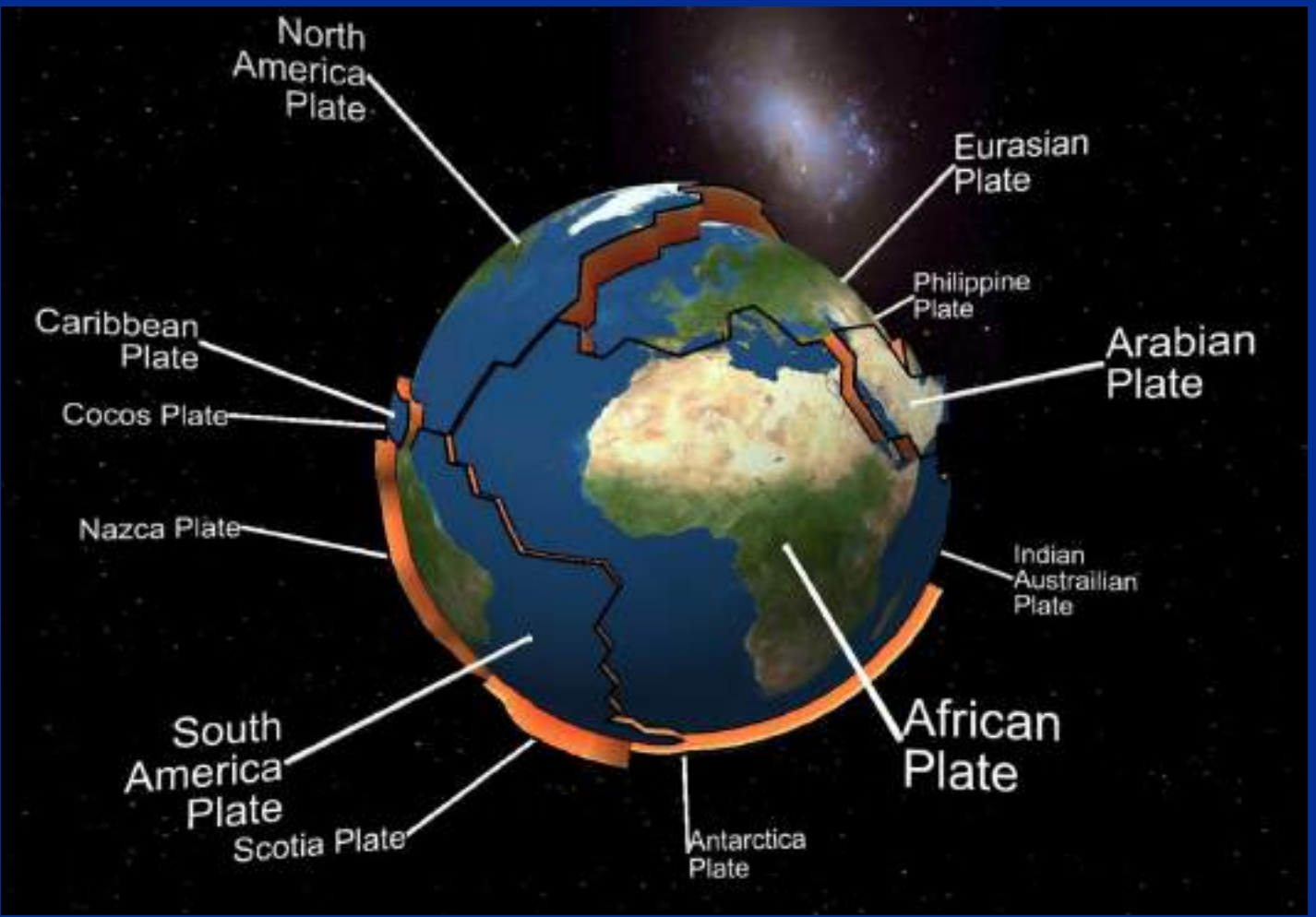
Tectonic history of Arabian Plate



Tectonic history of Arabian Plate

Arabian Shield and Arabian Platform

- The Arabian Platform (Shelf) occupies 2/3 of the Arabian Plate
- The Arabian Shield occupies 1/3 of the Arabian Plate



Tectonic history of Arabian Plate

Arabian Shield and Arabian Platform

- Pangaea super-continent
- Gondwana super-continent

  - Pangaea was the most recent supercontinent and existed about 335 million years ago, while Gondwana existed about 510 million years ago.

Pangaea

Gondwana

Modern Word

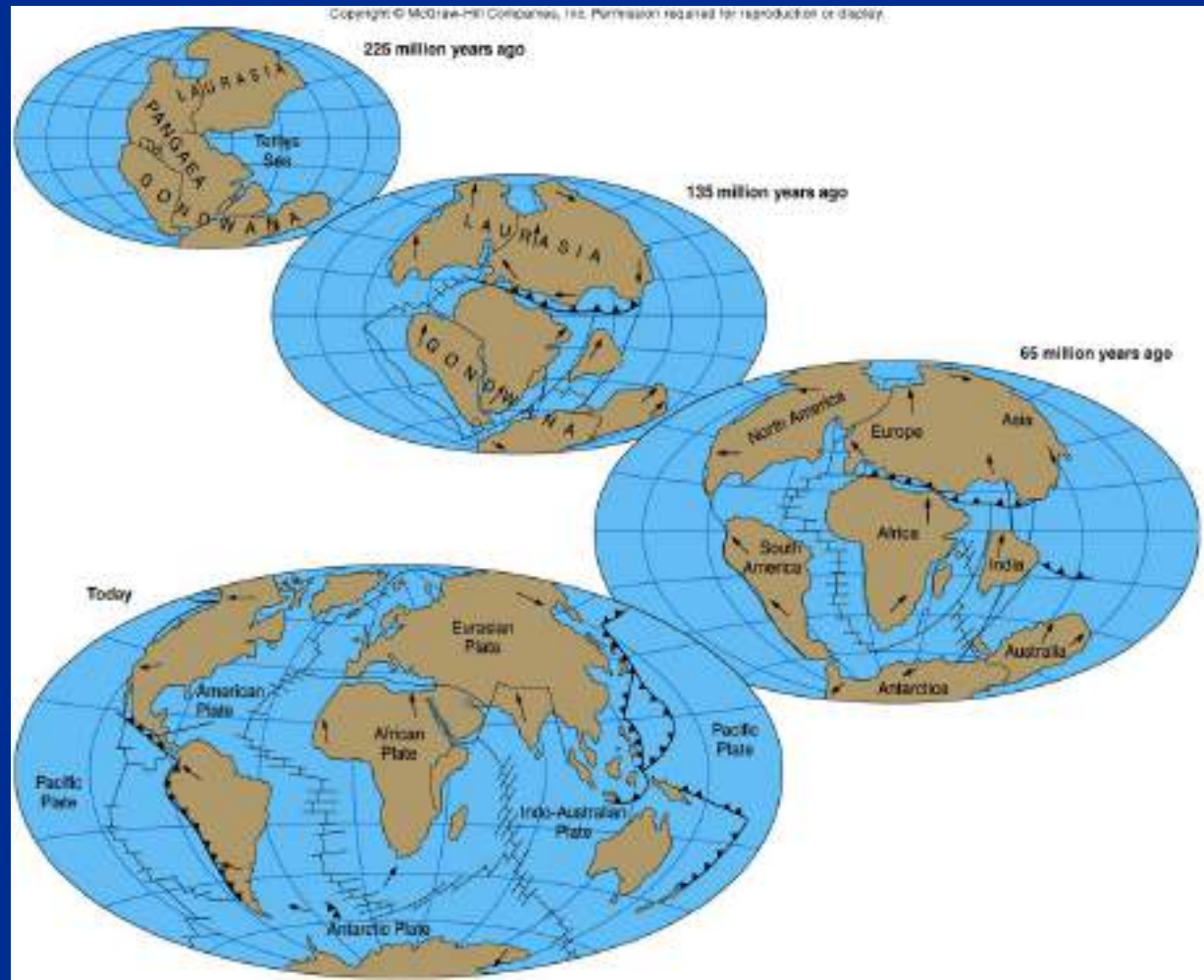
Tectonic history of Arabian Plate

Arabian Shield and Arabian Platform

- Pangaea super-continent
- Gondwana super-continent

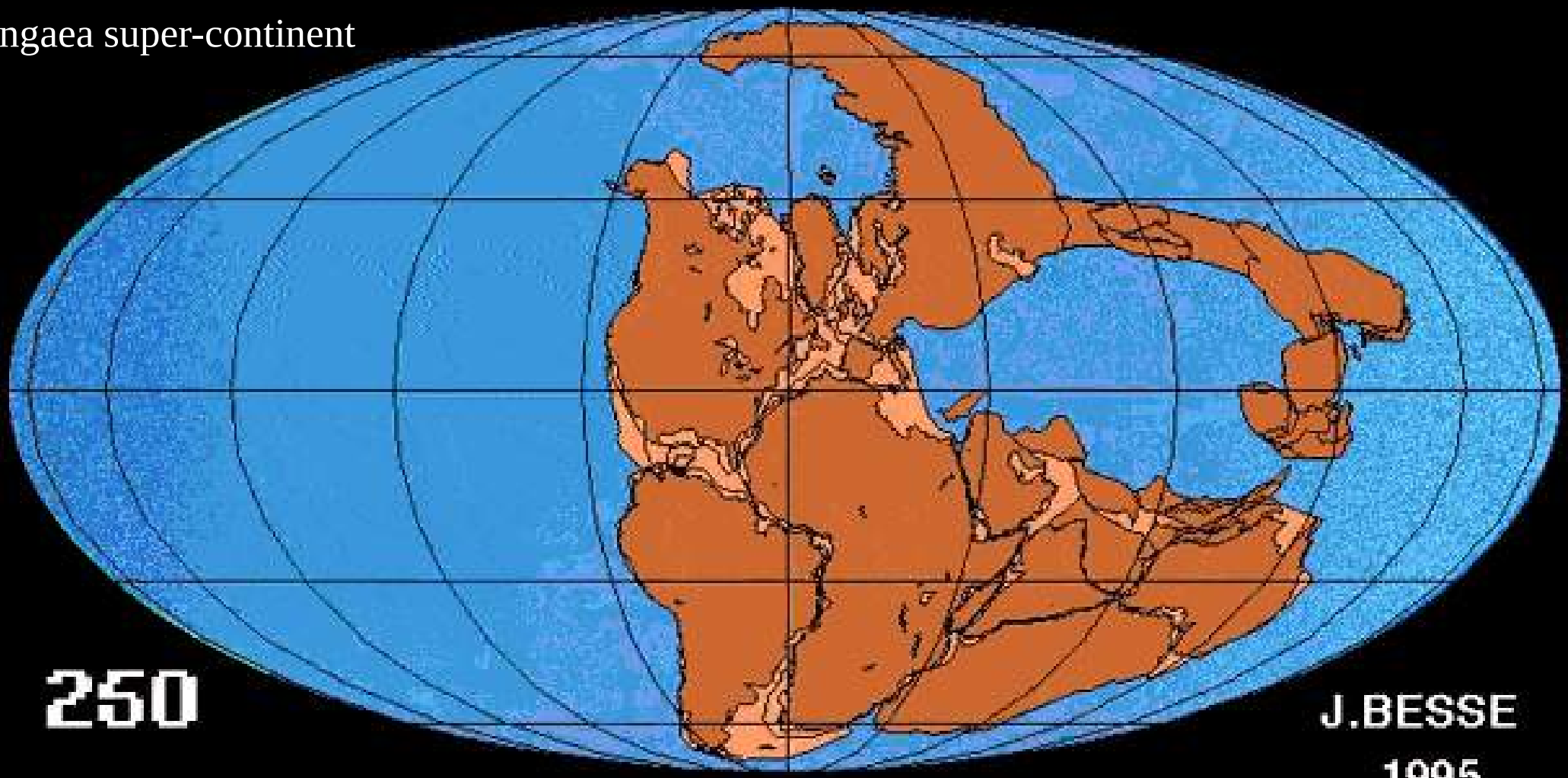
  - Pangaea was the most recent supercontinent and existed about 335 million years ago, while Gondwana existed about 510 million years ago.

  - Break-up of supercontinent Pangaea



Tectonic history of Arabian Plate

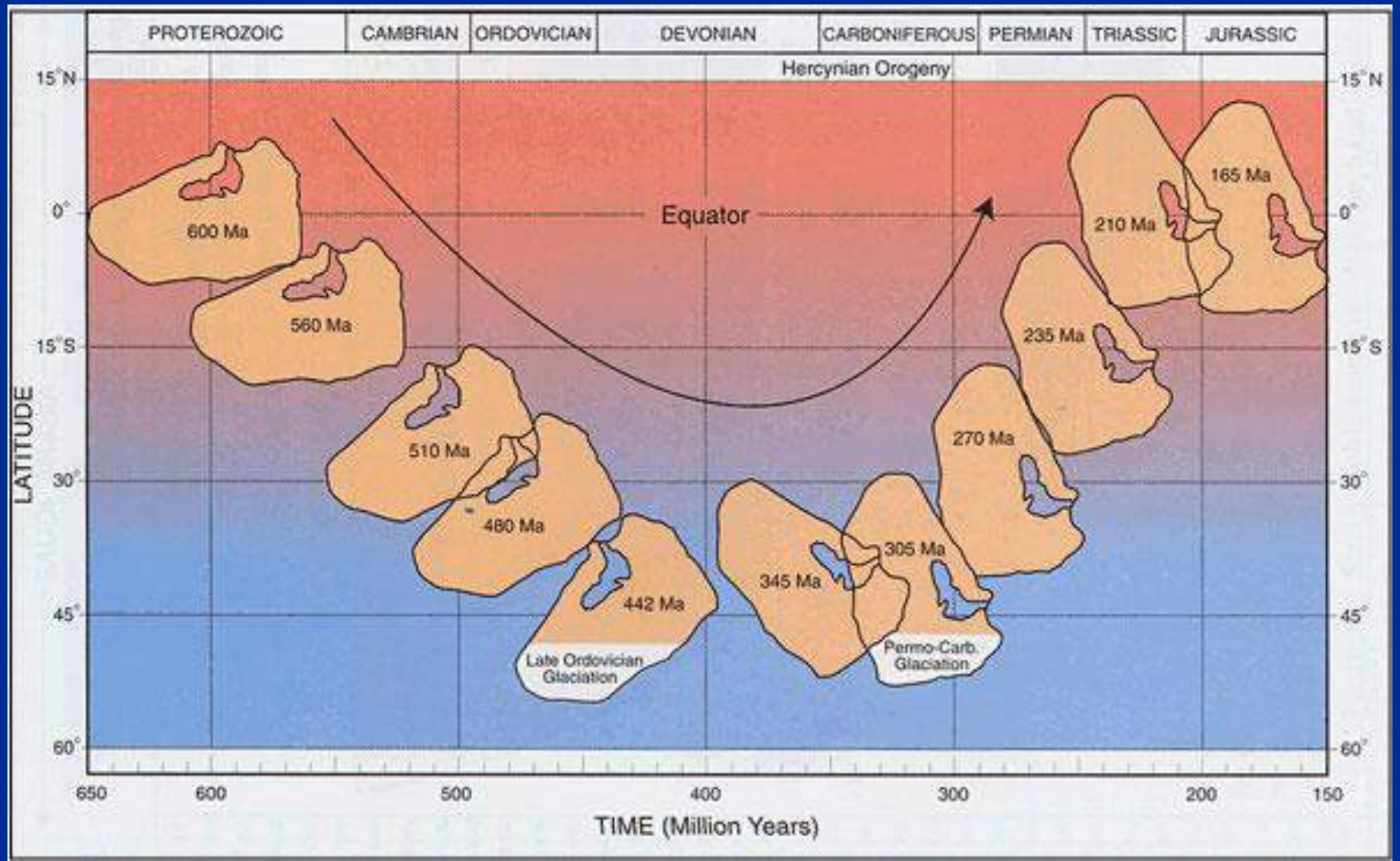
- **Arabian Shield and Arabian Platform**
  - Pangaea super-continent



Tectonic history of Arabian Plate

Arabian Shield and Arabian Platform

- Arabian plate

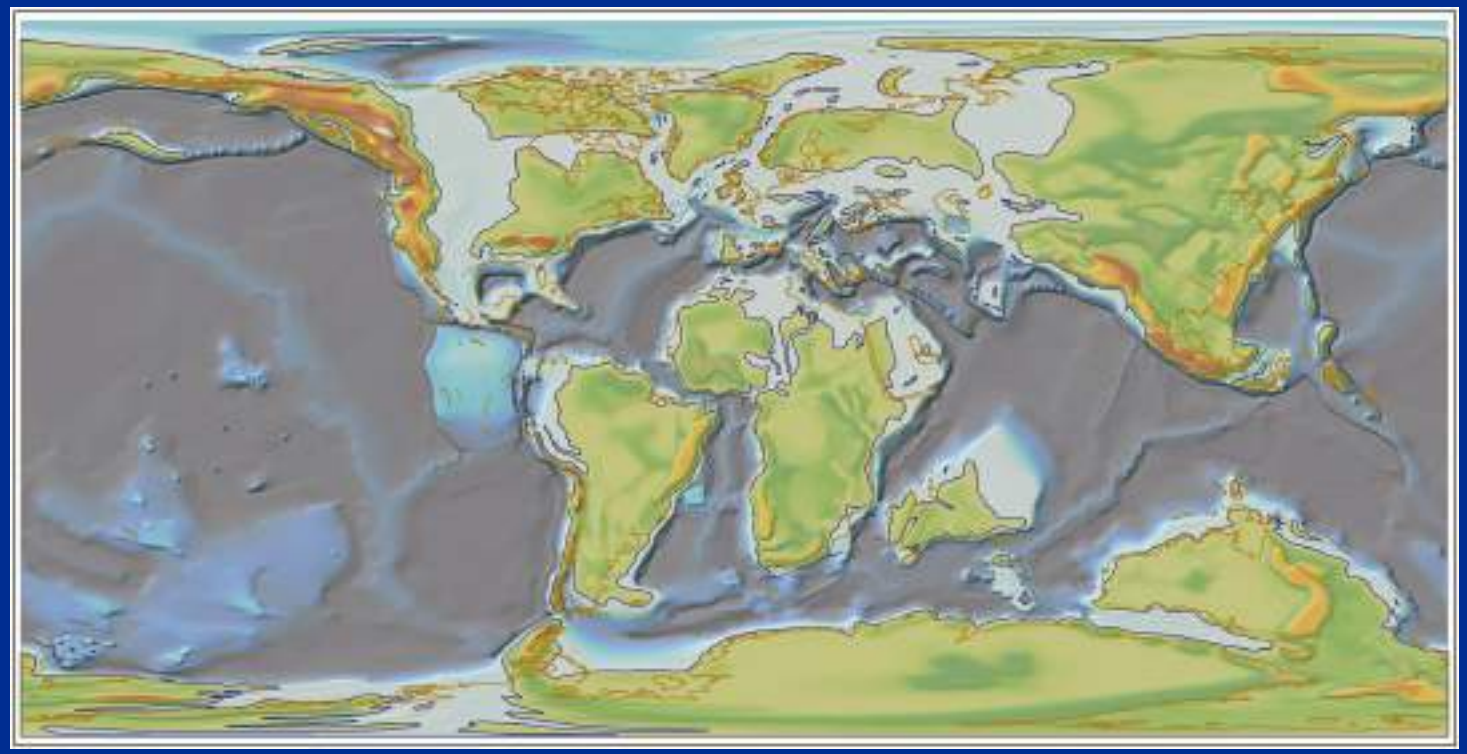


Tectonic history of Arabian Plate

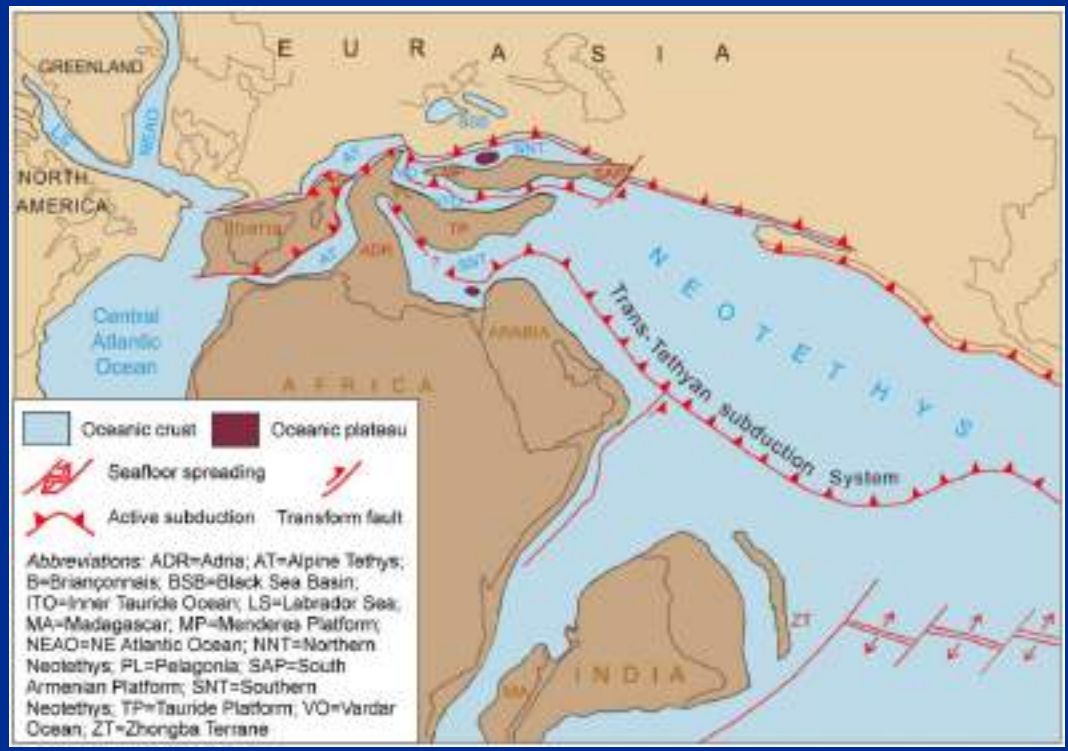
Arabian Shield and Arabian Platform

Arabian plate

- The Arabian Plate was part of the African plate during much of the Phanerozoic Eon (Paleozoic – Cenozoic), until the Oligocene Epoch of the Cenozoic Era. Red Sea rifting began in the Eocene, but the separation of Africa and Arabia occurred in the Oligocene, and since then the Arabian Plate has been slowly moving toward the Eurasian Plate.



- Palaeo-digital elevation model for a period of eustatic high during the late Cenomanian–early Turonian. Created as part of the Neftex Product Suite from Halliburton and reproduced with permission.



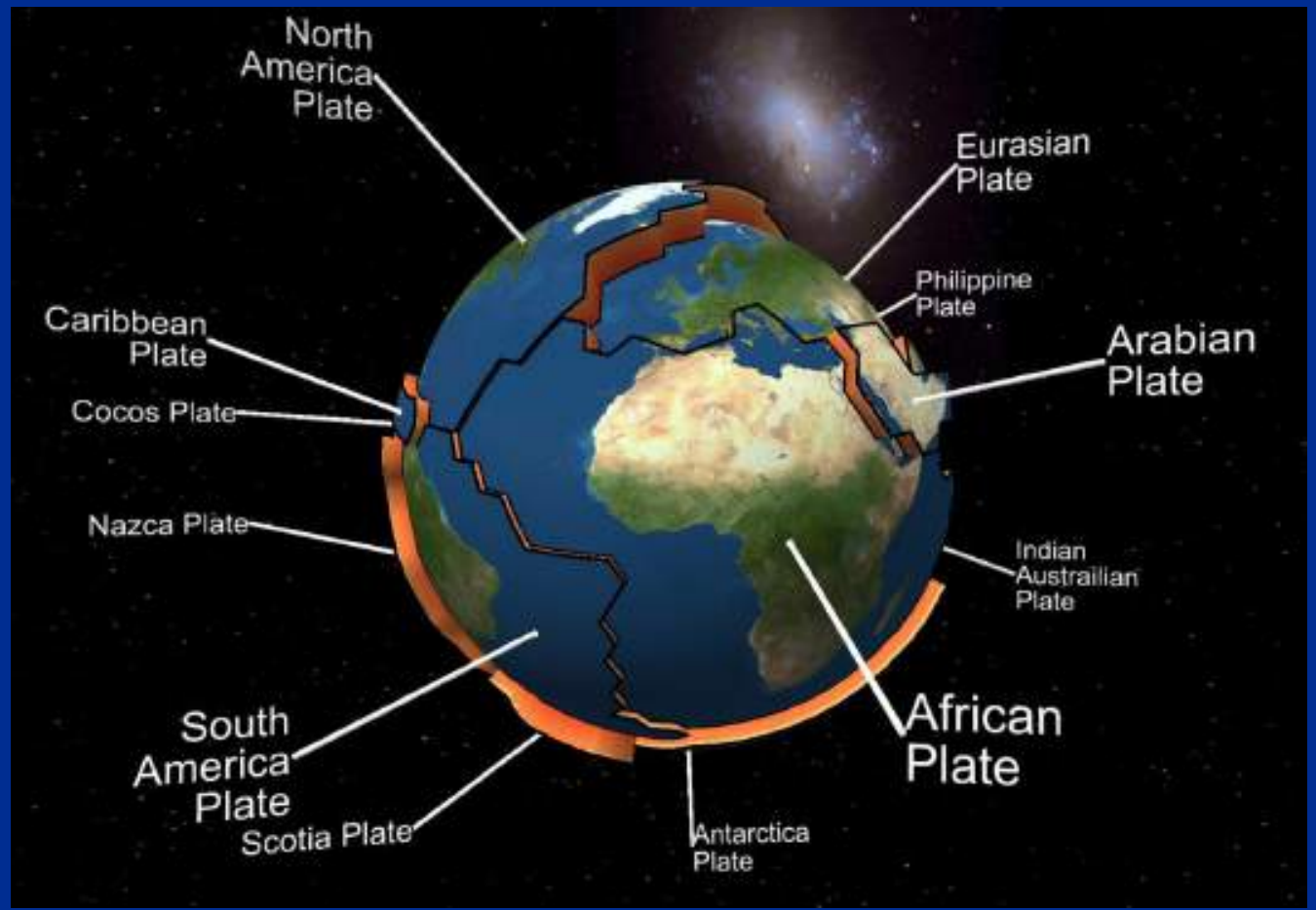
- Mid-Cretaceous subduction system in Neotethys (after Dilek and Furnes 2019 and references therein).

Tectonic history of Arabian Plate

Arabian Shield and Arabian Platform

Arabian plate

- Arabian plate is one of the youngest of the 10 or more plates that make up the present-day surface of the Earth.
- Arabian plate is a small plate surrounded by African plate to the west, Eurasian plate to the north and east and Indian plate to the south.

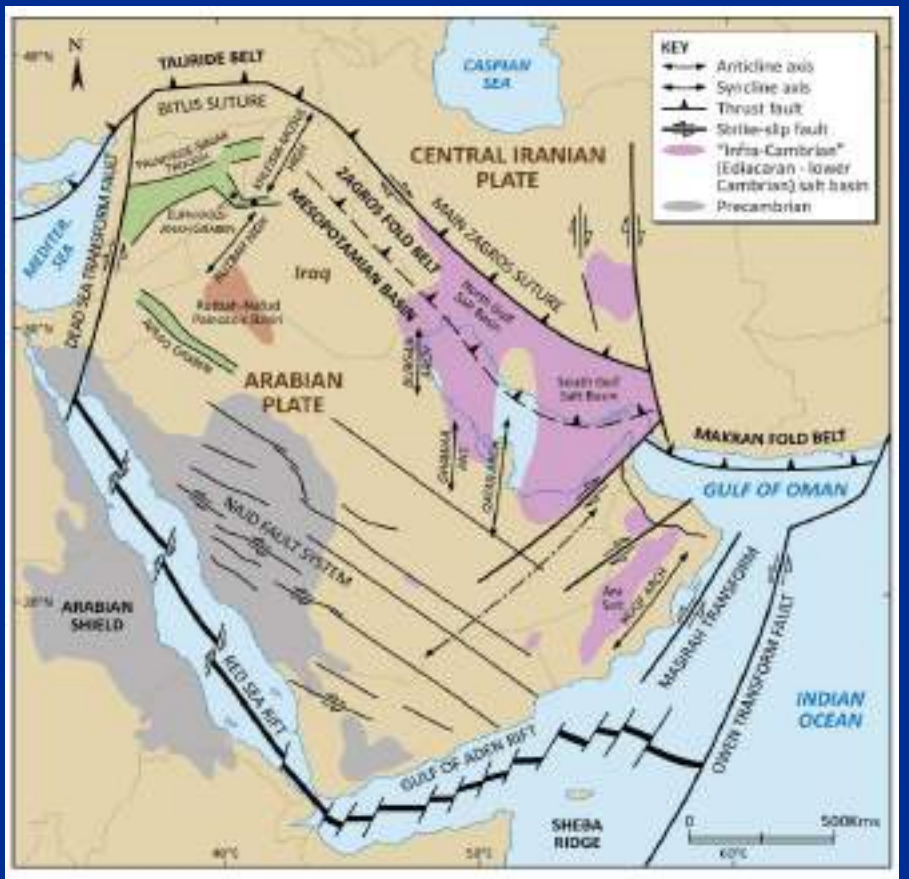


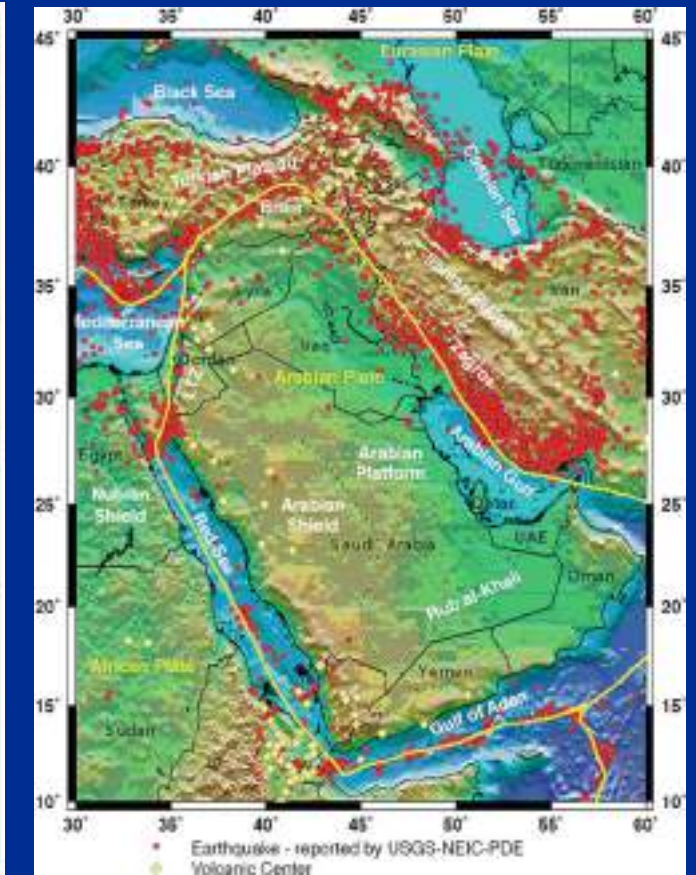
Tectonic history of Arabian Plate

Arabian Shield and Arabian Platform

Boundaries of Arabian plate

- Convergent boundary (Collision) between Arabian plate and the Eurasian Plate.
- Divergent boundary between Arabian plate and African plate along the Red Sea and Gulf of Aden.
- Transform boundary along Gulf of Aqaba-Dead Sea and Owen fracture zone.





Tectonic history of Arabian Plate

Tectonic history of Arabian Plate

- The Arabian Plate tectonic history can be subdivided into tectonic phases that shaped its geology. These include:
  - Precambrian
  - Ordovician-Silurian Glaciation / deglaciation
  - Carboniferous (Hercynian Orogeny)
  - Early Triassic (Zagros Rifting)
  - Late Cretaceous (First or Early Alpine Orogeny)
  - Tertiary (Second or Late Alpine Orogeny
  - Neogene Separation from Africa.

Tectonic history of Arabian Plate

Tectonic history of Arabian Plate

- The Arabian Plate tectonic history can be subdivided into tectonic phases that shaped its geology. These include:
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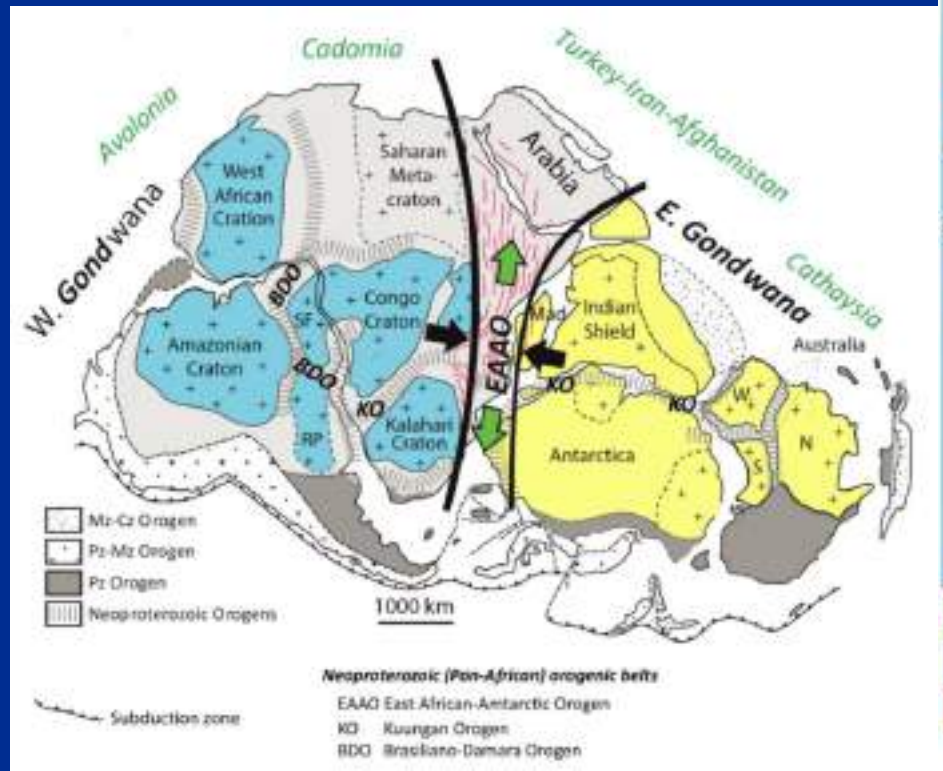
  - **Arabian Shield**

- The oldest portions of the Arabian plate formed in the middle to late Proterozoic (800-650 Ma) when a series of island arcs and micro-continental fragments accreted against the northeastern margin of the Pan African craton to form the Gondwana super-continent.
- Detail of the region between East and West Gondwana showing the tectonic setting of the Arabian-Nubian shield (part of the East African orogen)



Tectonic history of Arabian Plate

Tectonic history of Arabian Plate

- The Arabian Plate tectonic history can be subdivided into tectonic phases that shaped its geology. These include:
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  - **Arabian Shield**

- The Late Precambrian development of the Arabian Plate played an important role in the subsequent tectonics that inherited their tectonic weaknesses.
- Eight terranes (crustal blocks) are recognized: the Midyan, Hijaz, Ha'il, Afif, Ar Rayn, Ad Dawadimi, Jiddah, and Asir terranes.
- The terranes are identified mainly by differences in geochronology, stratigraphy, and structure.
- Collision of the initial blocks occurred around 690 Ma. The resulting suture zones are marked by intense deformation and by ultrabasic rocks interpreted as ophiolites.

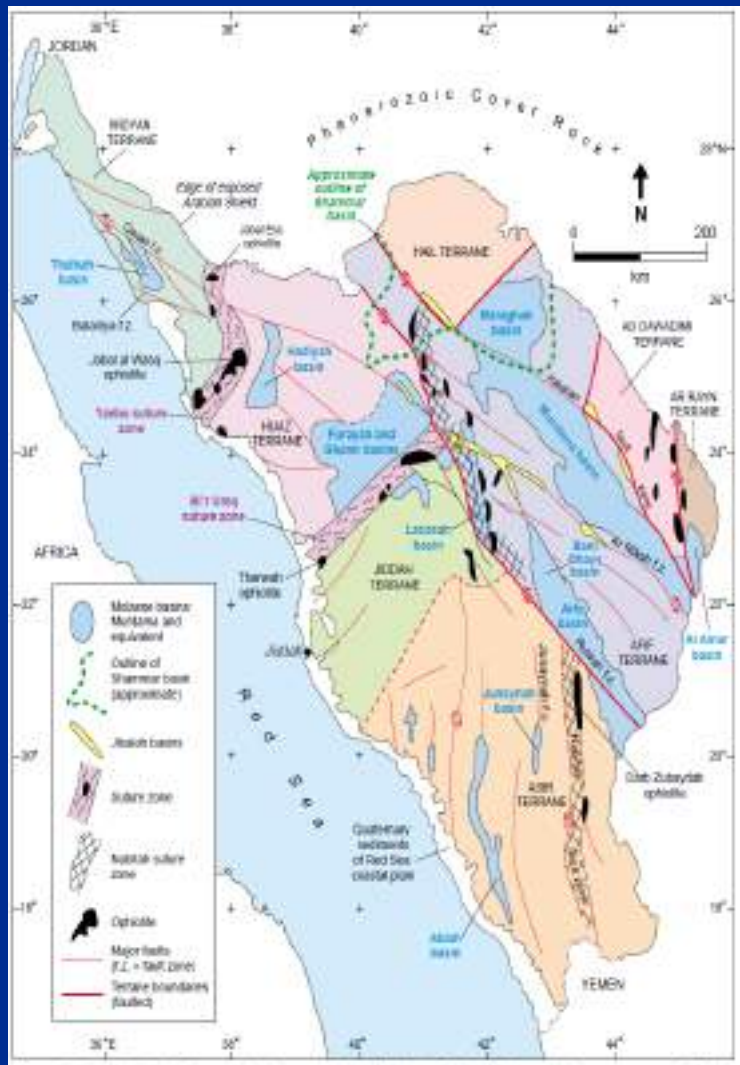

Figure 3: Simplified geologic sketch map of the Arabian Shield showing the terranes and their boundaries, and the main Pan-African structural features and sedimentary basins. Major fault zones, such as Ruwaih, Ar Rikabi, Halaban, and Qazaz, belong to the Najd fault system.

Tectonic history of Arabian Plate

Tectonic history of Arabian Plate

- The Arabian Plate tectonic history can be subdivided into tectonic phases that shaped its geology. These include:
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  - **Arabian Shield**

- Evolution of the Arabian Plate, terranes outcropping in the Arabian Shield . By 715 Ma the Asir, Hijaz and Midyan terranes had joined to form the western part of the Arabian Shield. Between about 680 and 640 Ma the Afif terrane collided with the western shield along the Nabitah suture.
- At about 640 Ma subduction started west of the Rayn terrane forming the Amar Arc. This led to closure of the 'Amar Sea' around 610 Ma when the Afif and Rayn terranes collided along the Amar suture.
- This collision, the Amar orogeny of Al-Husseini (2000), may have initiated the subsequent Najd phase of major wrench and thrust faulting and folding.

Tectonic history of Arabian Plate

Tectonic history of Arabian Plate

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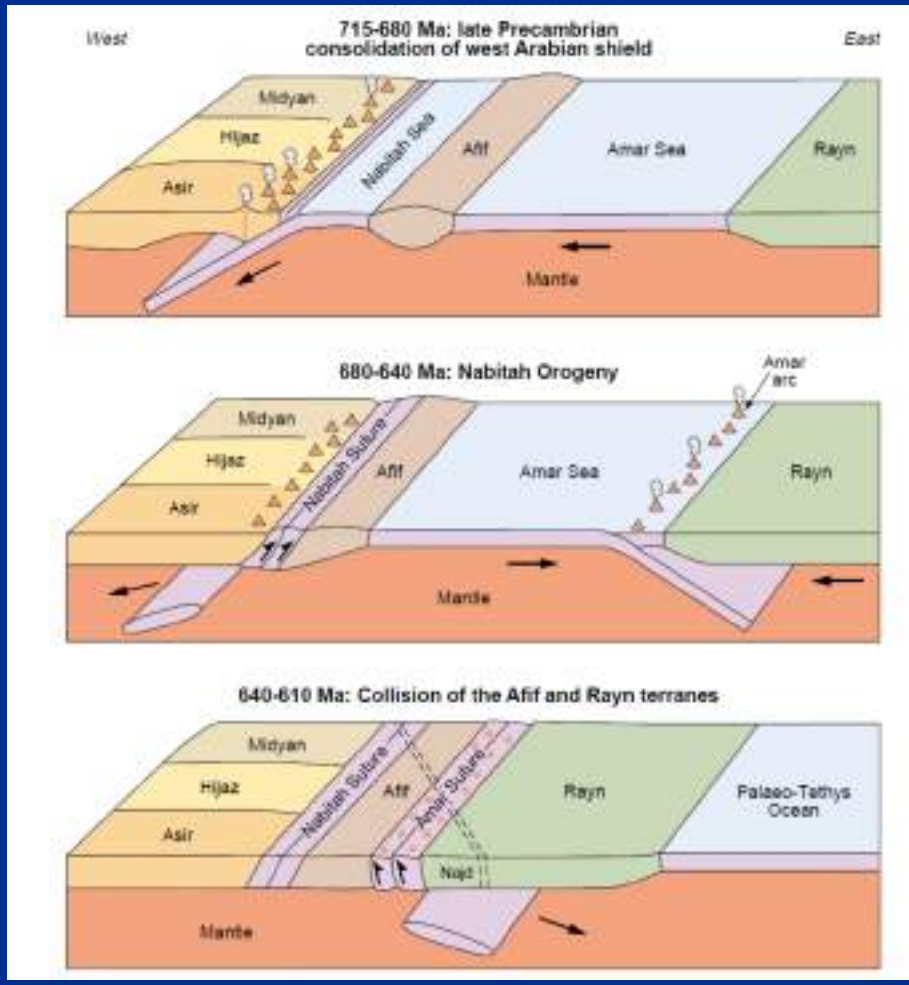
Precambrian Basement Accretion: (c. 715-c. 610 ma)

- During the late Precambrian, a series of basement terranes began to coalesce on what was to become the Arabian margin of Gondwanaland
- Five of these terranes (the Midyan, Hijaz, Asir, Afif and Ar Rayn) outcrop in the Arabian Shield in Saudi Arabia, where both
- The orientation of sutures separating the mosaic of terranes and basement blocks is believed to be of fundamental importance to the subsequent development of the sedimentary cover. The two main suture trends visible in the shield are interpreted to extend beneath the sedimentary cover and make up a lattice-like mosaic across the entire plate area. They are interpreted to have had an influence on subsequent plate structuring, as evidenced by the strong present day north-south lineation across most of the plate.



Tectonic history of Arabian Plate

Tectonic history of Arabian Plate

- The Arabian Plate tectonic history can be subdivided into tectonic phases that shaped its geology. These include:
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  - **Arabian Shield**

• Precambrian rocks extend throughout the Arabian Peninsula, exposed as the Arabian shield in the west in Saudi Arabia, Jordan, and Yemen; concealed beneath as much as 12 km of Phanerozoic sedimentary rocks in the central part of the peninsula; and exposed in small outcrops in Oman in the east. Because of the Phanerozoic cover, the basement in central Arabia is poorly known but geophysical data indicate that the basement is unbroken across the region.