Kinematic and geometry change in the Zagros foreland and modification of the orogenic wedge

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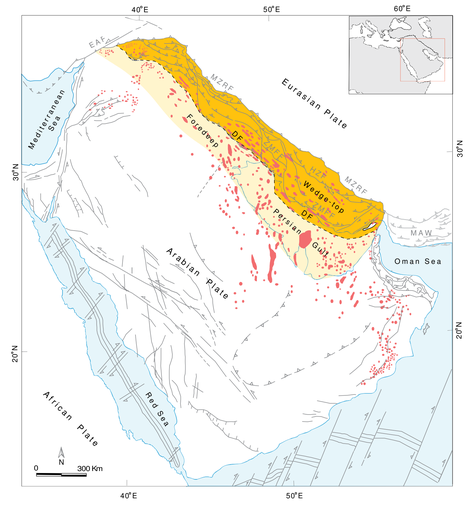
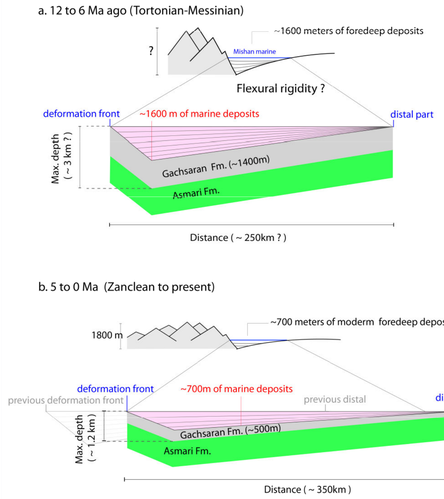
Zagros foreland basin

The Zagros Mountains comprise a Neogene-Recent foreland basin that is forming in response to ongoing collision between the Arabian and Eurasian plates. This foreland basin provides an ideal case where one can investigate the transition in time and space between the modern-day environments (e.g. wedge-top, foredeep) and older deposits that were progressively buried and incorporated into the orogen.



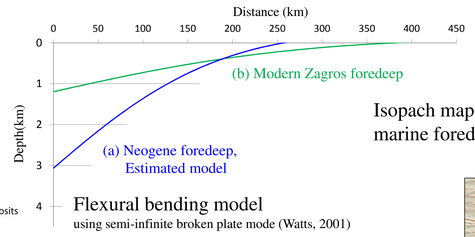
How the Zagros wedge develops ? (Ongoing project)

Eastern sector



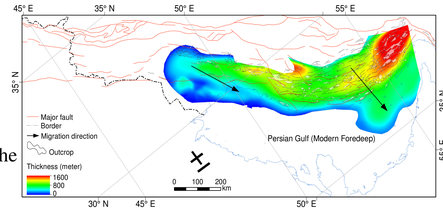
Schematic pattern of the Miocene (a) and Modern-day (b) setting of the Zagros foreland basin. The modern-day foreland basin is shallower and wider compared with the Miocene foreland basin in the eastern sector of the Zagros fold-thrust belt-foreland basin.

Our observations show that the foreland had a minimum depth of ~3km in the Late Miocene and eventually decreased to 1.2km in the eastern sector since the Pliocene. In comparison, the depth of the western foreland basin increased through the Neogene; and it has a depth between ~6 and ~7 km in present. This geometry variation represents a major change in the foreland kinematics and modification of the Zagros wedge taper about 6Ma in the eastern sector. The reason for this change needs to be elucidated in order to understand the role of climate, crustal and mantle dynamics.

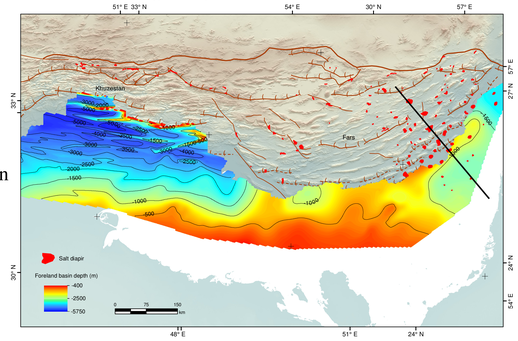


Flexural bending model
using semi-infinite broken plate mode (Watts, 2001)

Isopach map of the marine foredeep.

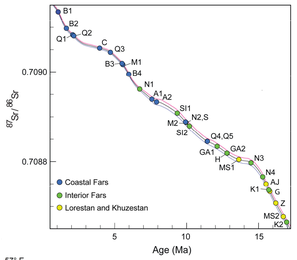


Base of the modern foreland basin deposits along the Zagros basin.

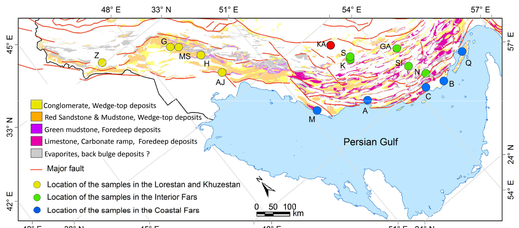


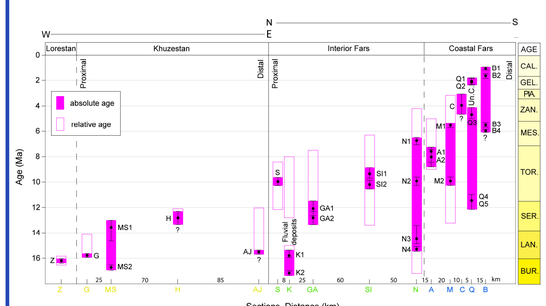
Strontium isotope stratigraphy

Plot of the Sr isotope age results of the Zagros marine foredeep deposits on the LOWESS curve (McArthur et al., 2001).



Map showing locations of samples analysed for strontium isotope stratigraphy across the Zagros region.

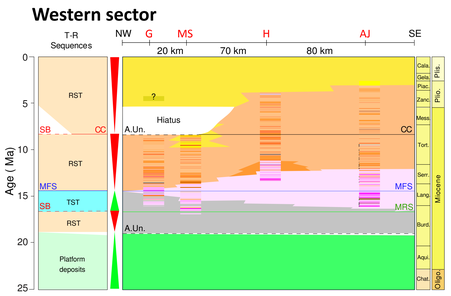




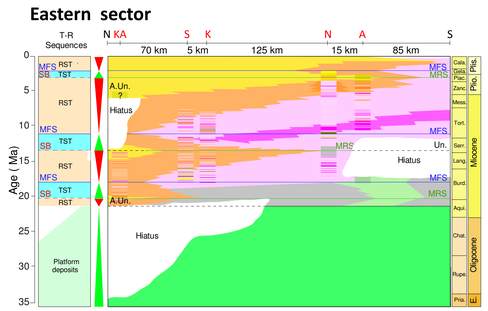
Distribution of the Sr isotope results of the marine foredeep deposits within the Zagros region. Absolute age ranges of the foredeep deposits are shown with pink filled quadrants, relative age range is shown with open quadrants (calculated based upon Sr dating results and net deposition rate). Question marks imply that the base of the foredeep deposits has no outcrop.

Zagros basin analysis

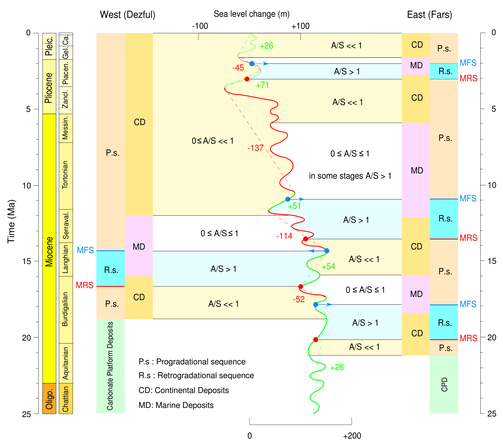
Western sector

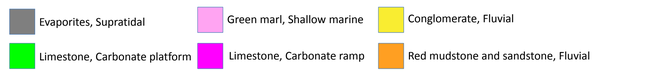


Eastern sector



Two chronostratigraphic charts from western and eastern sectors of the Zagros display different evolutionary histories along the orogen after Arabia-Eurasia Collision.





Summarized stratigraphic charts, lithological columns and global sea level change (Haq and Qahtani, 2005) in the Zagros region.

Different architecture of the sequences and their mismatch imply the strong impact of tectonics on the evolution of the basin. In addition, it can be inferred that the Zagros foreland basin did not respond in a simple manner along the strike to global sea level changes and shortening in the Zagros wedge during the Neogene.

The presence of the thick shallow marine foredeep deposits in the eastern sector along with a large amount of global sea level fall (-137m) indicates a strong influence of tectonic subsidence between 11Ma and 6 Ma.