

An attempt to reconstruct central and eastern Iranian ophiolite puzzle

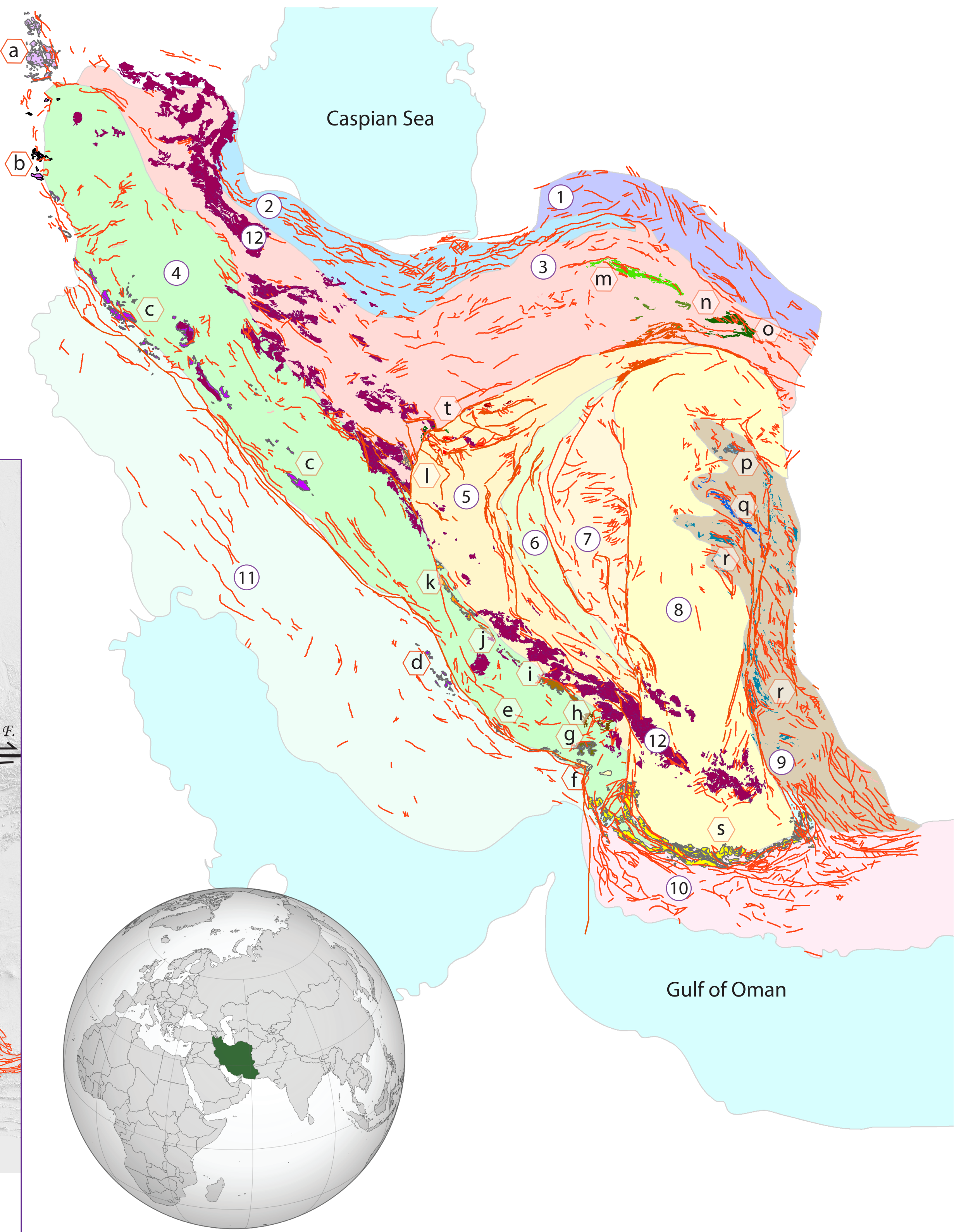
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1 Introduction

Iran is a mosaic of continental blocks that are surrounded by Palaeo-Tethyan and Neo-Tethyan oceanic relics. Remnants of the ophiolitic rock assemblages are exposed around the Central Iranian Microcontinent (CIM), discretely along the Sanandaj-Sirjan Zone and in Jaz-Murian. The present-day “ring” distribution of the Iranian ophiolites is not straightforwardly explained by a simple subduction zone architecture.

Figure 1: Tectonic Map of Iran



2 Methodology

We aim to kinematically restore the opening and closure history of the ocean basins found as ophiolitic relics around the CIM. In order to reveal the history of this area we collected quantitative kinematic evidence, such as, direction, amount, and/or timing of relative motion between geological units.

A Golden Rule : Rocks are usually more deformed than we think !!!

3 Blocks and Units in Central and Eastern Iran

- 1- Kopet Dagh
- 2-Alborz Mountains:
- 2-Great Kavir Block
- 4-Sanandaj-Sirjan Zone
- 5-Yazd Block
- 6-Kashmar-Kerman Shear Zone
- 7-Tabas Block
- 8-Lut Block
- 9- Sistan Suture
- 10-Makran
- 11-Zagros Fold and Thrust Belt
- 12- Urumieh-Dokhtar Magmatic Belt

Ophiolites

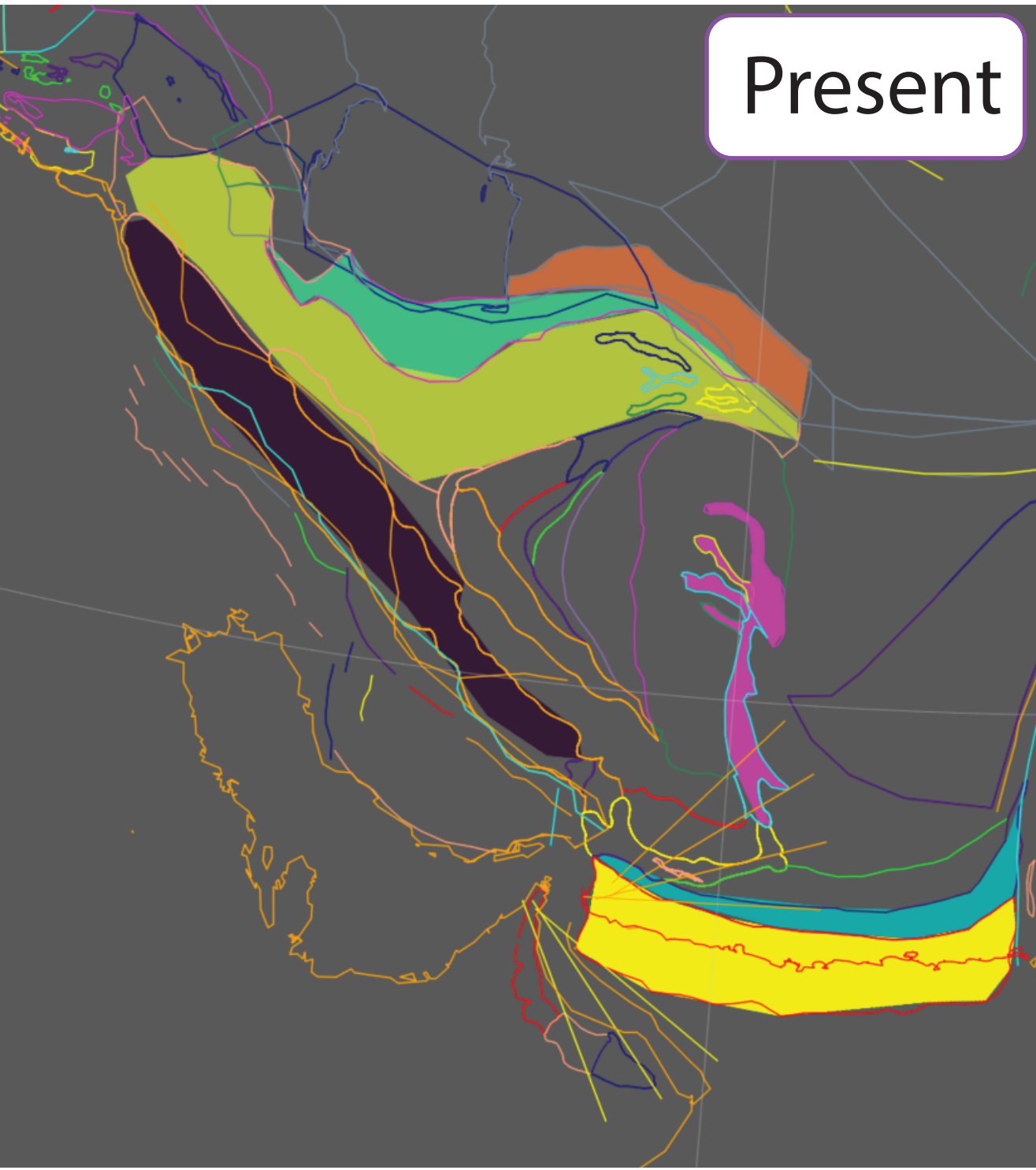
- a- Khoy-Maku 101-108 Ma
- b-Piranshahr-Serow 79 Ma
- c-Kermanshah-Kurdistan 101-86 Ma
- d-Neyriz 160-134 Ma
- e-Haji-Abad 94 Ma
- f-Kahnuj
- g-Esfandagheh
- h-Baft
- i-Balvard
- j-Shahr-e Babak
- k-Dehshir 100-94 Ma
- l-Nain 103-101 Ma
- m-Sabzevar 99-77Ma
- n-Oryan-Bardaskan
- o-Torbat-e-Heydarieh
- p-Qayen
- q-Birjand
- r-Birjand-Nehbandan ~110Ma
- s-Jaz-Murian 145-111 Ma
- t- Jandaq Palaeozoic

Outer Zagros Belt

Inner Zagros Belt

4 Results

Key features: the Doruneh and the Great Kavir faults Continuation of Herat fault (Afghanistan)



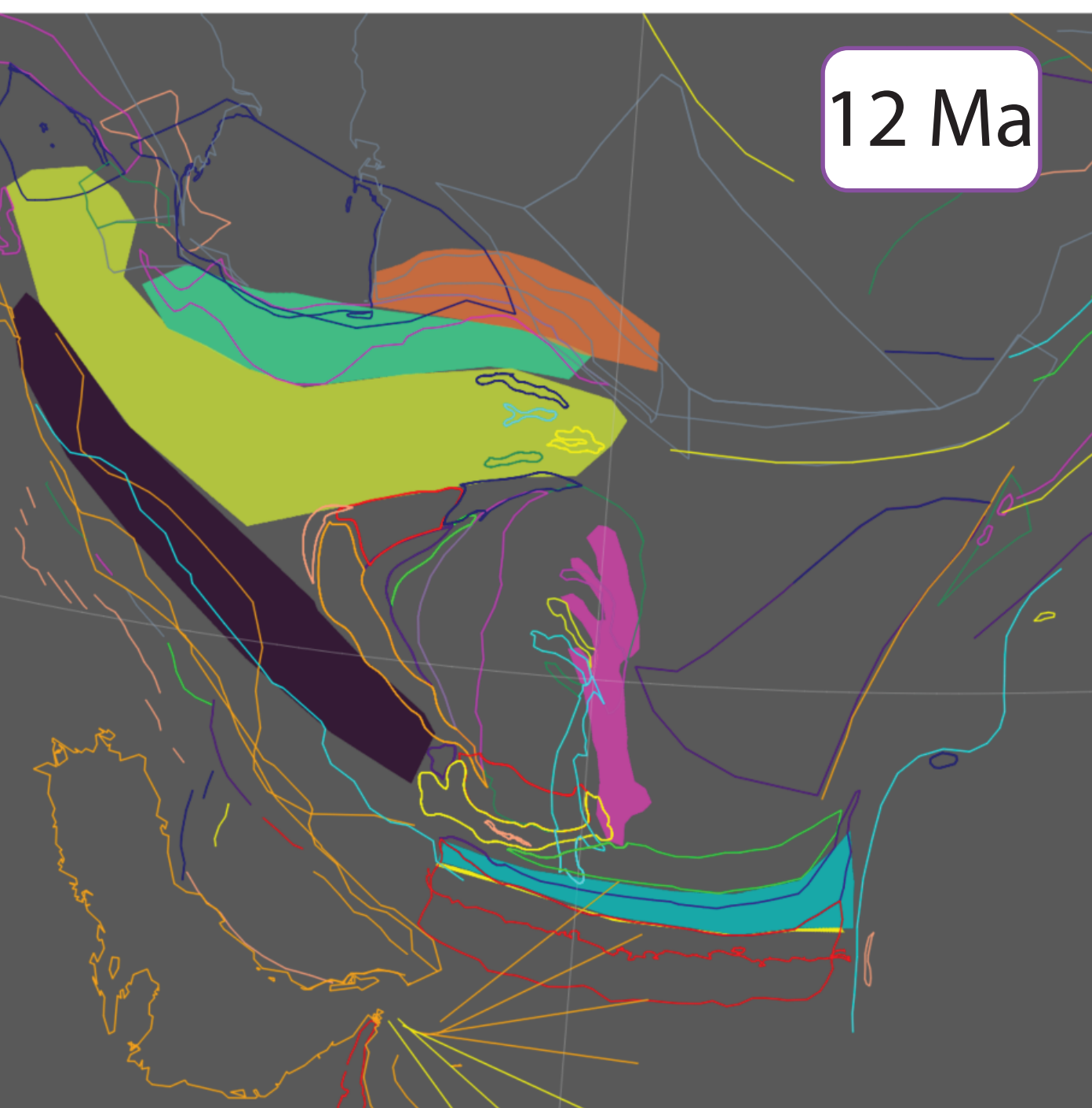
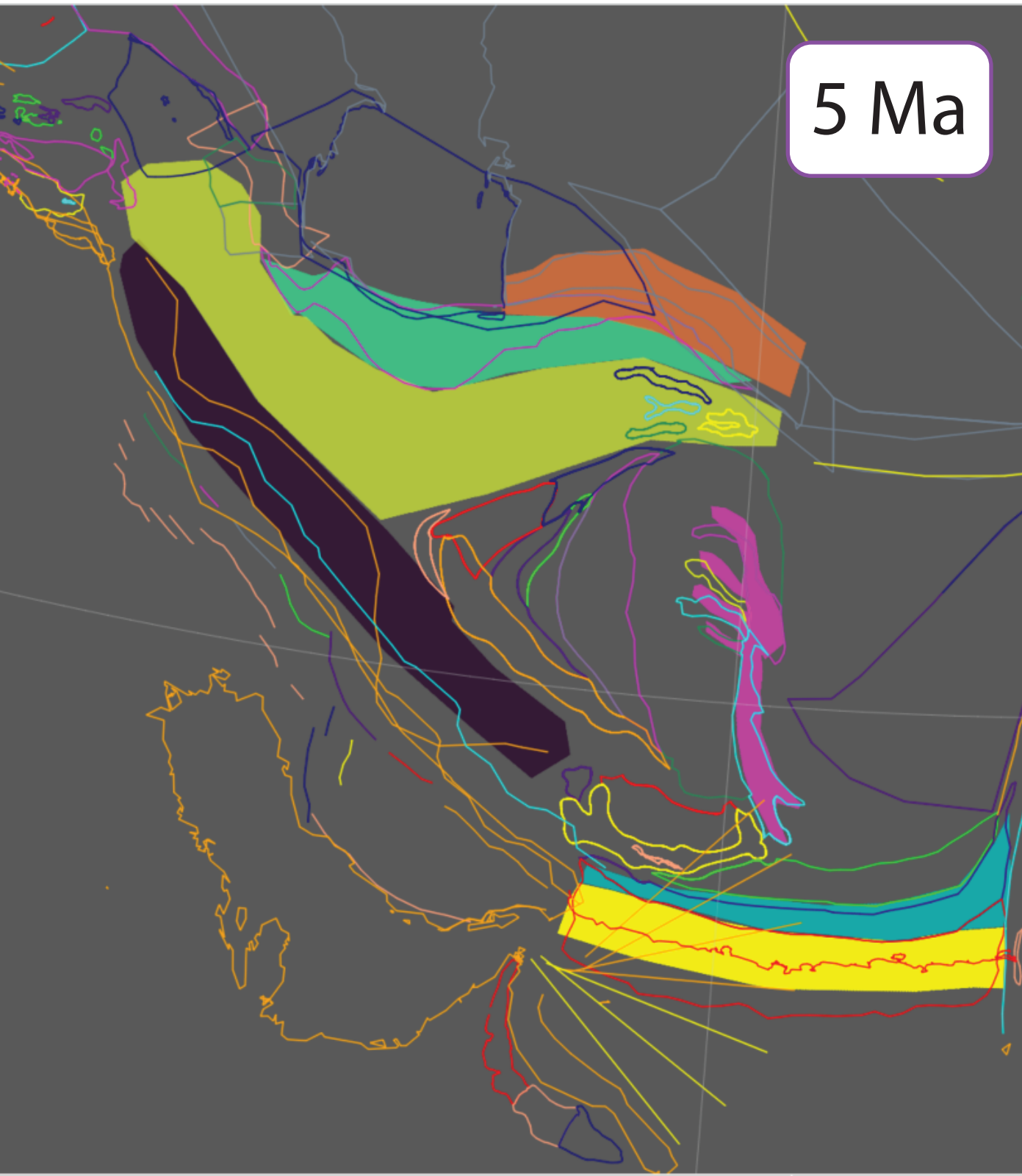
The CIM (Lut+Tabas+Yazd blocks), represents an Atlantic-type continental margin that began rifting in Permo-Triassic as a result of opening of Neotethys Ocean. Subsequent convergence in Cretaceous to Paleogene time close the ocean basins around the CIM and emplaced the ophiolites onto the passive margins. Neogene Arabia-Eurasia collision induced replacement structures e.g., strike-slip reactivation of normal faults that were associated with major block rotations.

Present-day GPS velocity vector measurements and deformation pattern show a NE-SW orientated shortening in Iran (Fig. 2).

Structural analysis of the Doruneh Fault indicates slip sense inversion before ~5 Ma. This observation is consistent with the deactivation of the dextral Herat Fault.

Pre-Pliocene dextral movement in excess of 500 km along the Doruneh and Great Kavir faults may kinematically accommodate a major counter-clockwise rotation (~65°) of the CIM since the late Jurassic that has been inferred based on previous palaeomagnetic studies.

Region	Age/Duration	Published amount	Sense of motion	Fault systems	Reference
West Central Alborz	after 12 Ma	53±3 km	shortening		Guest et al. 2006
	after ~5Ma	25 km	dextral slip	along the Nusha, Barir and Ton-e- Golu faults	Guest et al. 2006
	after 7~Ma		folding and bending of the front		Cifelli et al. 2015
W. Kopet Dagh	Post-Miocene	~75 km	shortening		Lyberis and Manby 1999
E. Kopet Dagh	Post-Miocene	~70 km	shortening		Lyberis and Manby 1999
Kopet Dagh	post-Miocene	35 km	dextral slip		Lyberis and Manby 1999
	late Quaternary	25 km	dextral slip	Anar Fault	Meyer and Le Dortz 2007
Central Iran/ Sanandaj-Sirjan	Post-Eocene-Oligocene	50- 65 km	displacement in Urumieh Dokhtar Magmatic Belt	Dehshir Fault	Meyer et al. 2006 Boshroabadi et al. 2018
Sanandaj-Sirjan	post Miocene	~ 40 km	shortening		Afrania 2015
Makran/Sanandaj-Sirjan	after 5~ Ma	6 km	shortening		Molinaro et al. 2005
Lut Block	after 5~ Ma	12-15 km	dextral slip	Gowk Fault	Walker and Jackson 2004
	~6-5 Ma	~50-65	dextral slip	East Neh Fault	Walker and Jackson 2004
Sistan Suture		~10 km	dextral slip	West Neh Fault	Walker and Jackson 2004
	Post-Eocene	13-20 km	strike slip	Zahedan Fault	Walker and Jackson 2004



5 Conclusion

This reconstruction implies that the closure history of the Central Iranian basins is directly connected to the large-scale Cretaceous to Paleogene extrusion tectonics in western Tibet and Hindu Kush regions. This preliminary study shows restoration of the post-Mesozoic deformation is essential to reconstruct the suture zones and pre-collisional setting in Iran, Afghanistan, and Pakistan.

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