The Protogonos

A Palaeozoic magmatic arc along the northern margin of Gondwana-Land and its disruption during the formation of Pangaea

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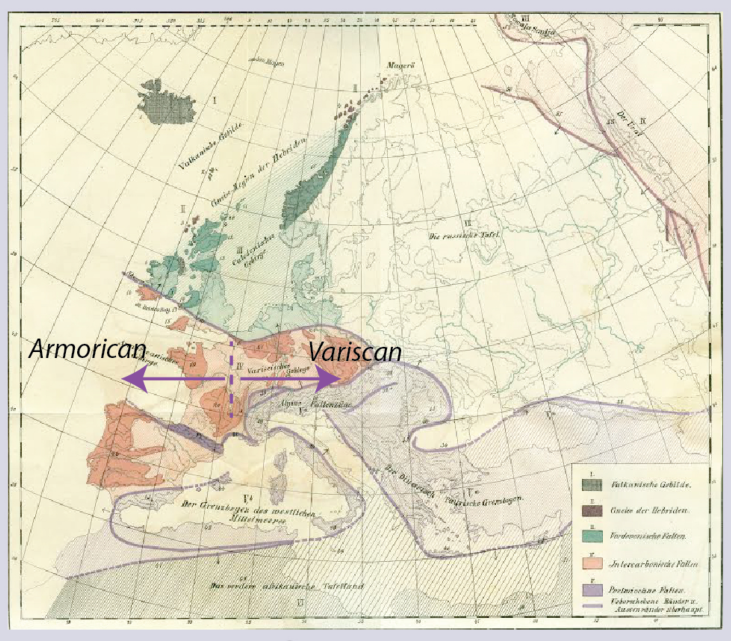
1 Introduction

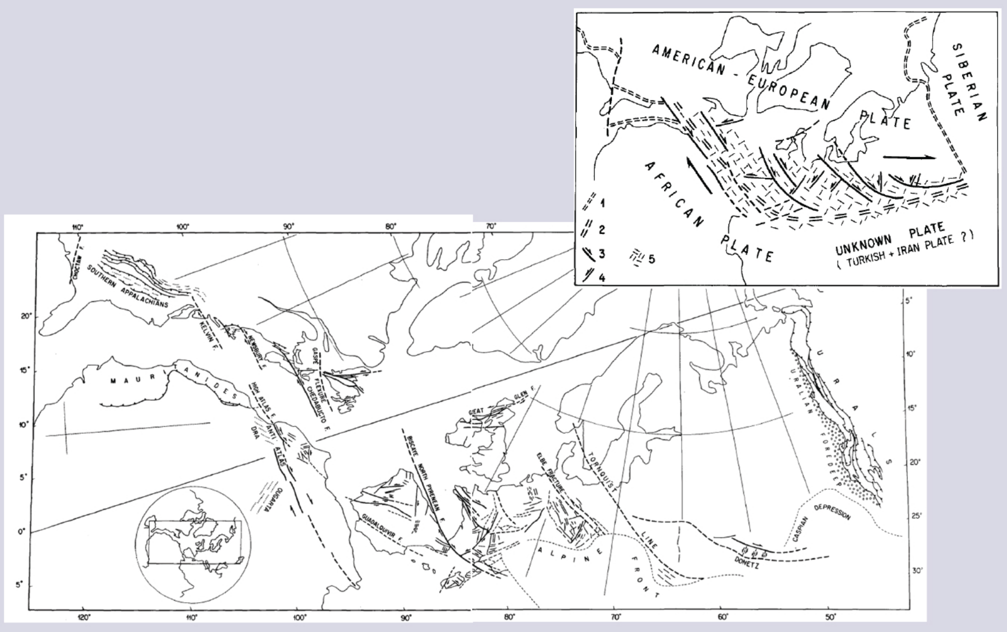
The Hercynian Orogenic Belt occupies a 1000 km wide swath from the North Sea to the Sahara and a ~8000 km long swath from the Carpathians to Mexico. The final amalgamation of Pangaea took place in the late Carboniferous resulted in formation of this orogenic belt.

Hercynian, Variscan or Alleghanian?

An orogenic belt, older than the Alpides and younger than the Caledonides was first described by Suess (1886). Divided into two, along the Massif Central syntaxis Suess named them as Variscan in the east, Armorican in the west. In 1887, Bertrand tied the Appalachian to Variscan and Armorican and named this orogen"Hercynian".



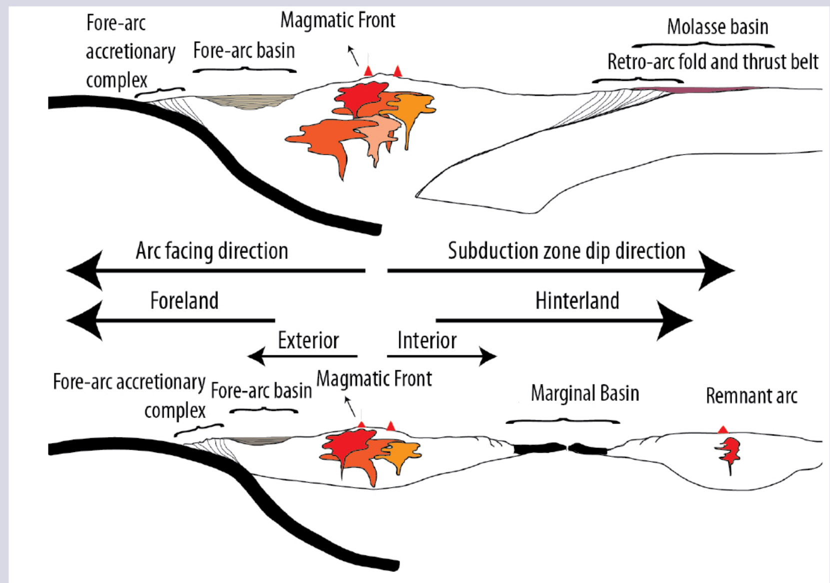
Suess 1886



Arthaud and Matte 1977

2 Methodology

This methodology is based on those distinct rocks assemblages representing specific body parts in orogenic belts such as magmatic arc, fore-arc and back-arc regions. These body parts may not be developed fully in every orogenic belt but the most common and prominent feature among all these is the magmatic arc. Properly-identified and well-dated magmatic rocks can be used as indicators of geodynamic environments, and even as reliable witnesses of geodynamic evolution and the former plate boundary.



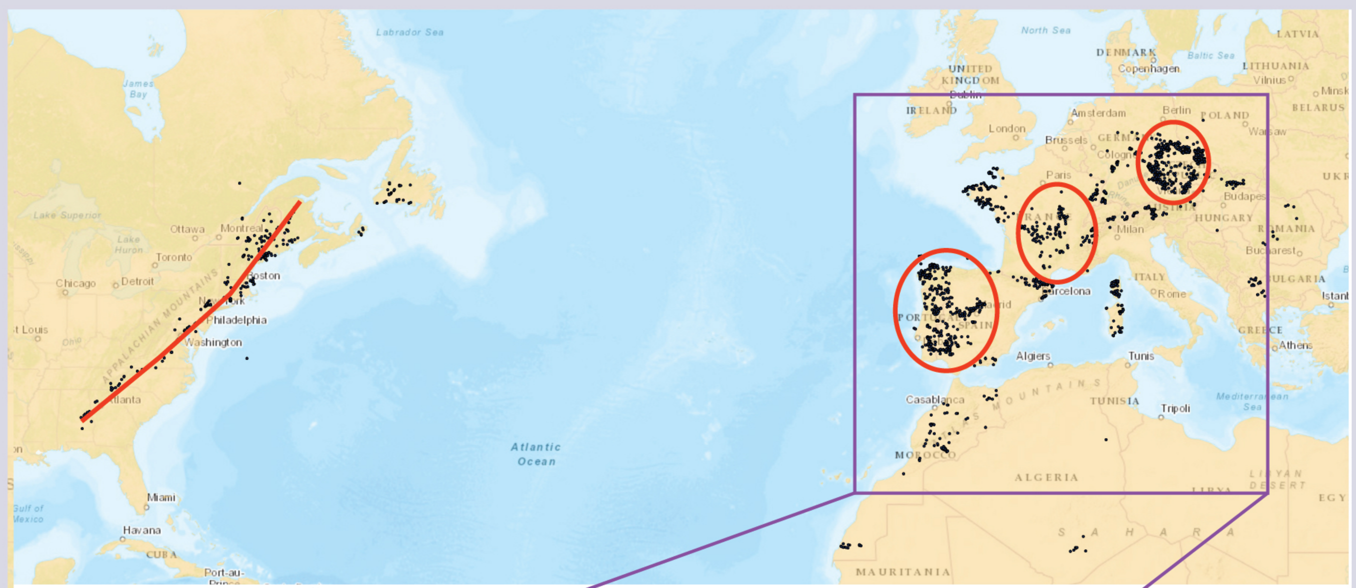
Lom et al. 2018

In order to create more accurate reconstructions of orogenic belts every primary and secondary tectonic unit within them should be properly identified and their original geometries estimated. Following the magmatic arcs is the best guide in this process, as it provides a hypothesis to be tested, together with apparent polar wander paths, palaeontological and geochronological data.

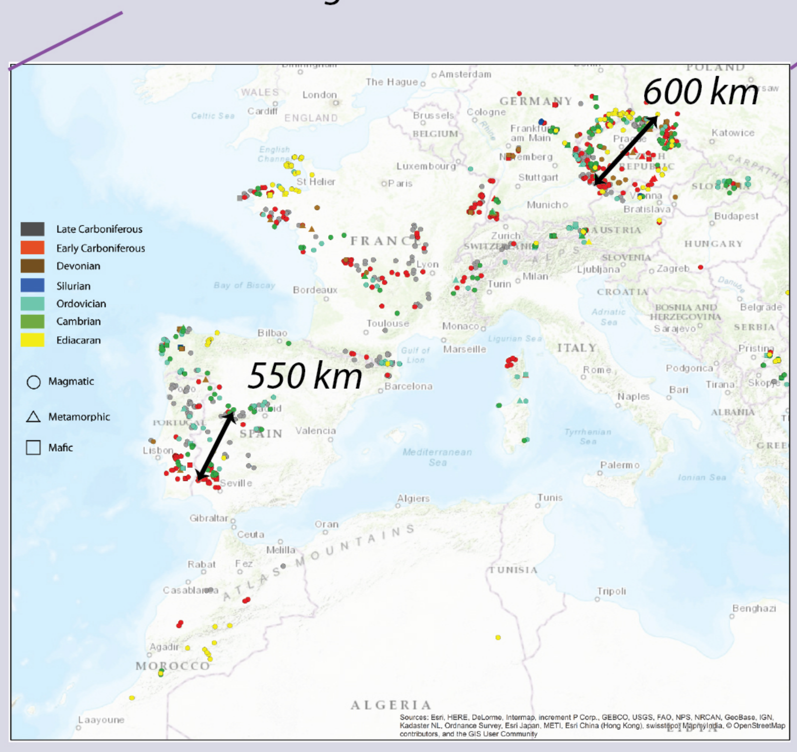
Identifying the magmatic arc is the crucial step in reconstructing a former orogen. Once it is determined it is possible to rebuild the architecture of the orogen!!!

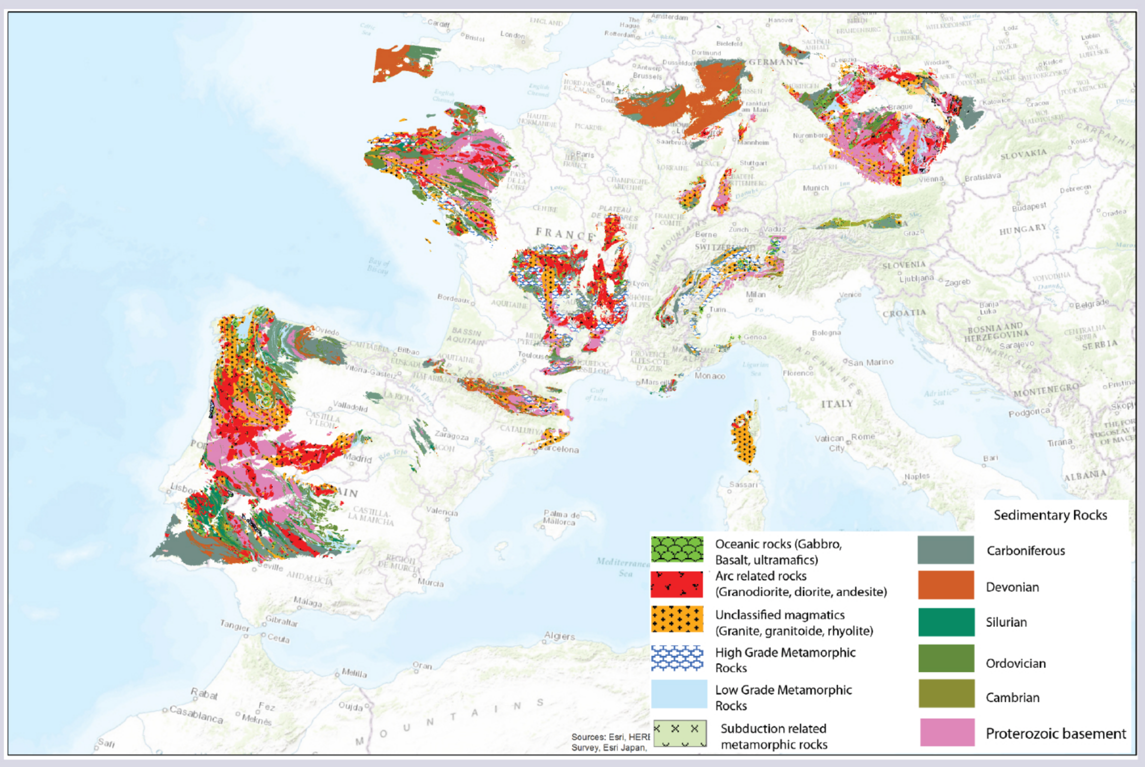
3 Hercynides

The intermediate and felsic magmatic rocks (granodiorites, diorites, andesites, granites, and rhyolites) are used to identify the magmatic arcs.
~2800 high quality isotopic age data were collected from the published literature. Stratigraphic, detrital or inherited ages are excluded and 1240 of them are interpreted as products of arc magmatism.

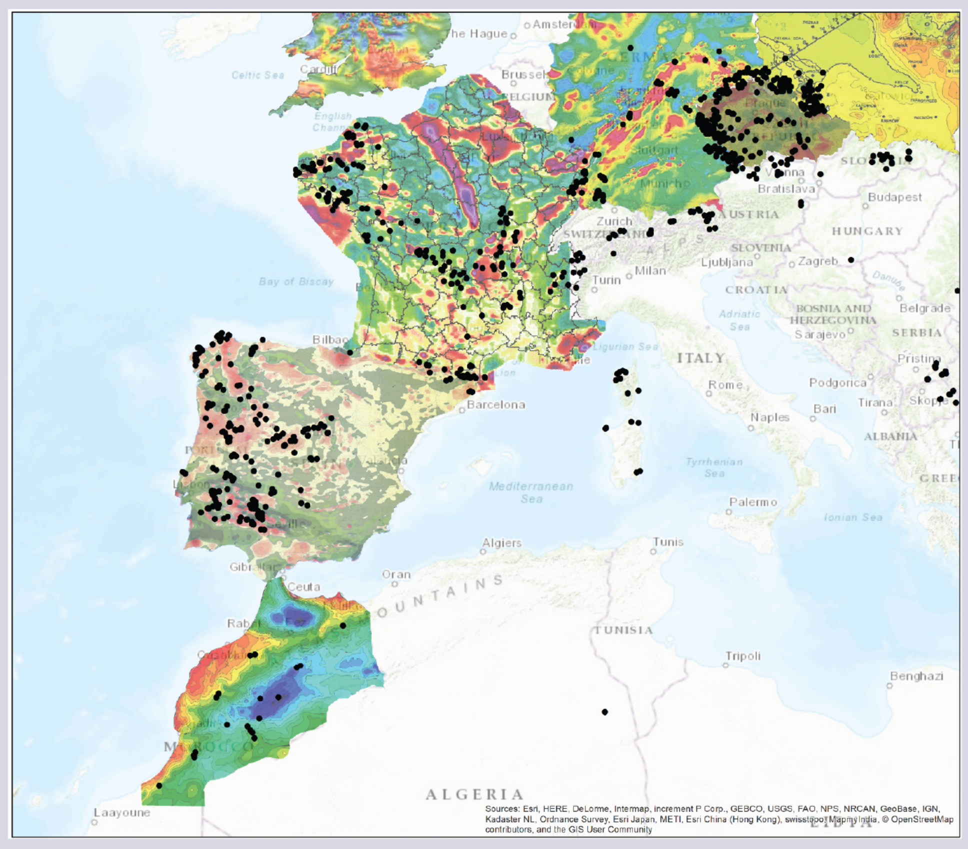


* *Linearity of arc related magmatic rocks in Appalachians vs. clusters in Europe*
* *Continuous arc magmatism from Ediacaran to the late Carboniferous*

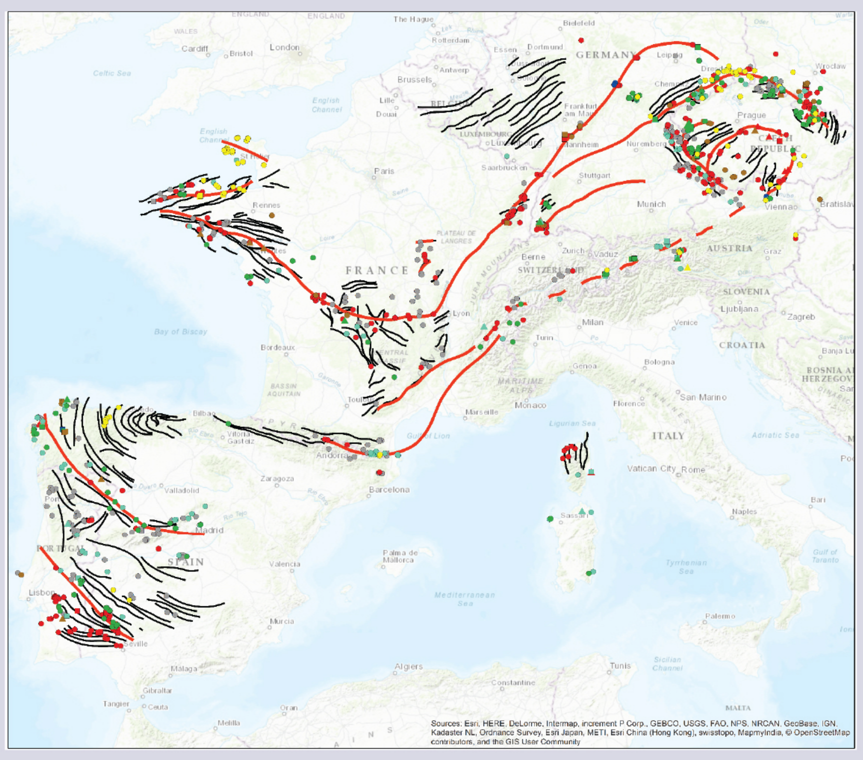




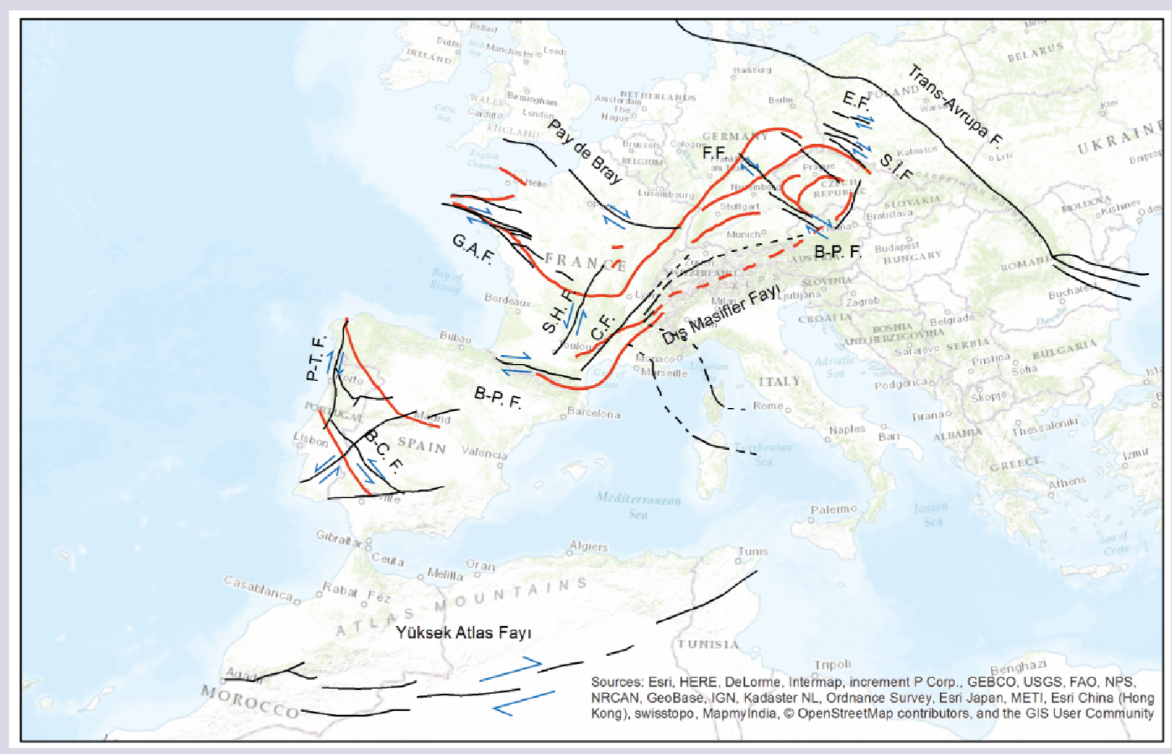
Simplified geological map of Europe (pre-Permian)



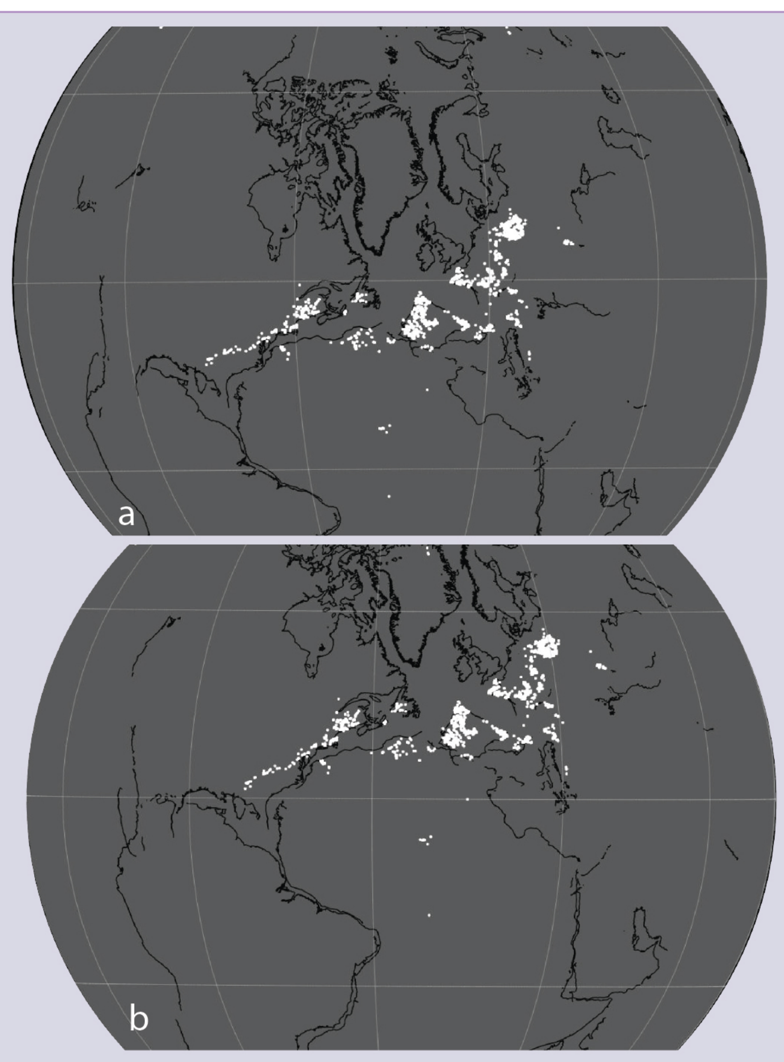
Combined magnetic anomaly map of European countries



Arc fragments (red lines) deduced from magmatic rocks, magnetic anomaly maps with the guidance of trendlines (black lines)



Major fault systems of Hercynian (red lines: arc fragments; black lines: faults; blue arrows: sense of motion along these faults

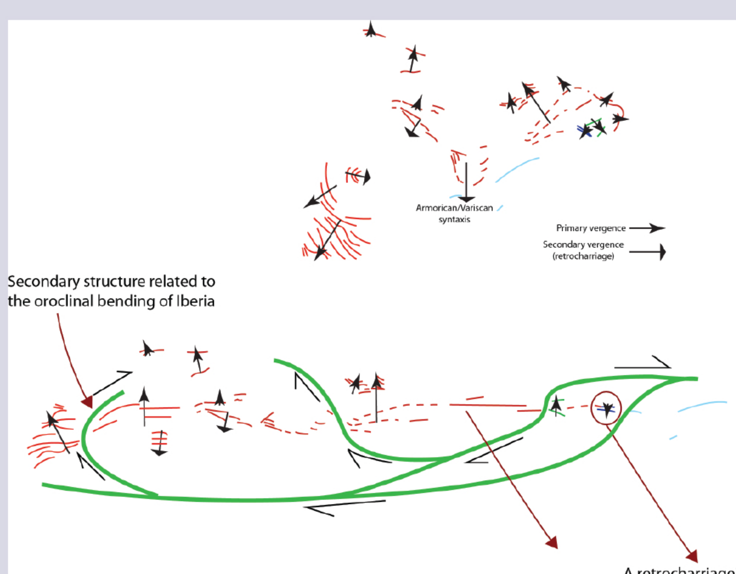


Pangaea A reconstructions for 300 Ma (a) and 250 Ma (b) (GPlates) (Domeier et al. 2012) . Clustering in Europe still exists.

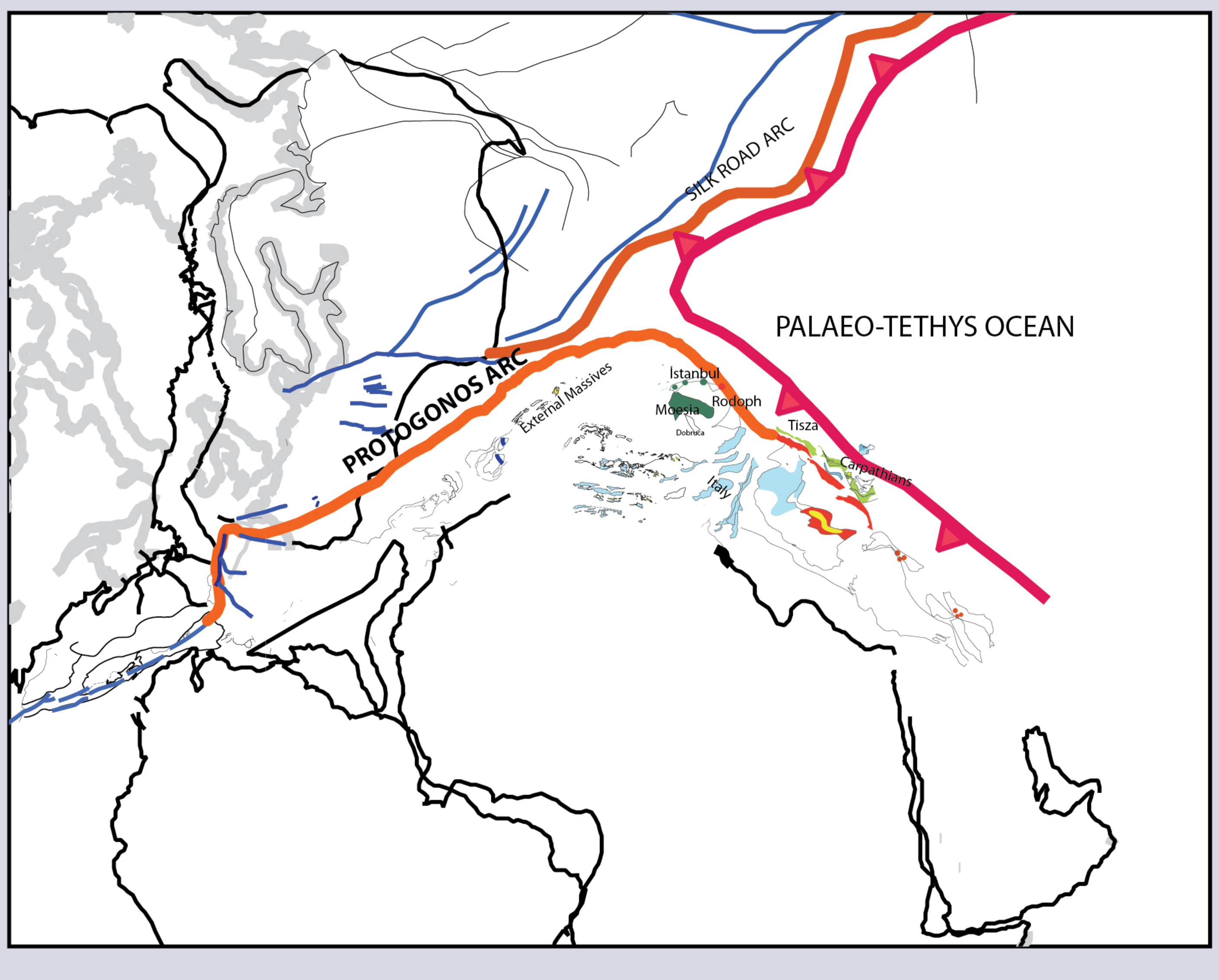
4 Conclusion

Magnetic anomaly maps and structural trend lines are used as supplements in identifying the extent of these disrupted magmatic arc fragments. These fragments are restored according to the approximate displacements on the major transcurrent faults at that time, which we partly identified. The long-lived magmatic arc is named "Protogonos" (=the first born).

In addition to the major fault systems, the proposed displacements to tie up the arc fragments justify a Pangaea-B geometry during the early Permian and a Pangaea-A geometry by the end of the Triassic, possibly by the end of the Permian as palaeomagnetically supported. The new reconstruction, the Protogonos model is based on the comparative anatomy of the orogenic belts, and it is a hypothesis to be tested.



Simplified view of trendlines in Hercynides and their reconstruction in a dextral transform fault system



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