CHRONOLOGY OF THE GEODYNAMIC EVOLUTION OF THE SARDINIA CHANNEL

J.-P. Bouillin[1]*, P. Monié[2], G. Poupeau[1], G. Mascle[1] and the SARCYA et SARTUCYA cruises scientific Party

[1] LGCA, UMR-CNRS 5025/UJF, Grenoble, France. - bouillin@ujf-grenoble.fr

[2] Institut des Sciences de la Terre, Montpellier, France - monie@dstu.univ-montp2.fr

Abstract

Two stages of crustal extension account for the structure of the Sardinia Channel. The first, during the Upper Oligocene - Lower Miocene is related to the creation of the Algerian back-arc basin to the north of the Maghrebide Chain. The second stage, during the Tortonian, is related to the opening of the Tyrrhenian Sea behind the Calabrian-Peloritan arc.

Key-words Basin formation, Back Arcs, Tyrrhenian Basin, Algerian Basin

The Maghrebide chain extends from Gibraltar to Calabria. Between the Peloritani Mounts of Sicily and the Lesser Kabylia, a part of the internal zone of the chain as been deeply submerged in the Sardinia Channel.

The rocks sampled in the Channel are similar to those which outcrop in Kabylia, Peloritani Mounts and Calabria (CPK). Observations in submersible, samples and sismic profiles allow to reconstitute the same structural setting both in the channel and CPK, with an hercynian basement overlain by Oligocene and Miocene sediments.

The rocks sampled in the Sardinia Channel are less intensively deformed than those of the alpine shear-zones known in CPK. Samples were studied using the $^{40}Ar/^{39}Ar$ method in order to characterize the alpine reworking of the hercynian basement. Most of them partially preserved $^{40}Ar/^{39}Ar$ Hercynian ages. Alpine re-opening of the minerals increases southeastwards, from the scarps of the Sardinian Valley to the southern slope of the Cornaglia Basin where Cenozoic ages were measured in the first degassing fractions.

Isotopic data may be interpreted in the framework of a progressive transition from the hercynian Sardinian basement, not affected by the alpine deformations, to the CPK basement involved in the Maghrebide Chain.

Furthermore the hypothesis of an eo-alpine suture which would have separated Sardinia from the CPK massifs is not supported by any one of the numerous samples collected in the Channel nor by any observation on the sea-floor.

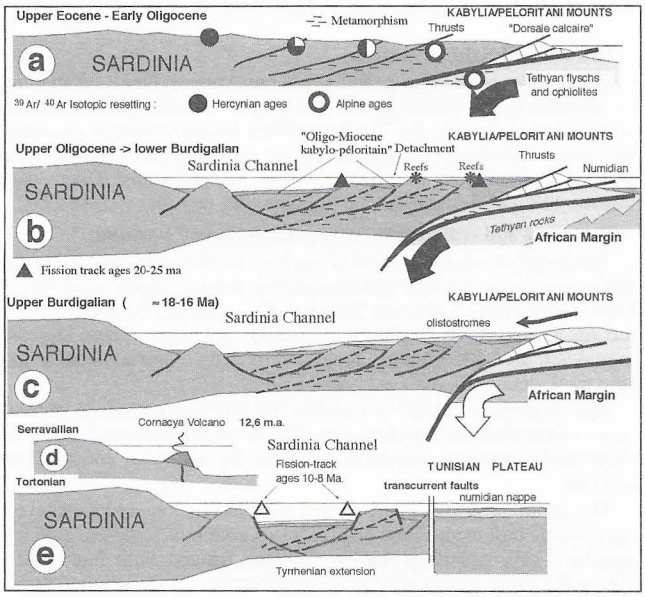
Thus, we can reconstitute the following stages of the channel evolution :

1) before upper Oligocene, the CPK massifs were connected to Sardinia and belonged to the Europe. They were fringed southward by a continental margin which became later the "Dorsale calcaire" unit. Further south, the Maghrebian basin of the Tethys separated this european margin from the african one.

2) during Oligocene, the CPK basement overthrusted the Maghrebian basin, due to the subduction of the Tethys below the european margin (fig; 1a).The CPK basement was cut itself by low-dipping thrusts. Seismic sections of the Sardinia Channel present reflectors gently dipping to the northwest which have been interpreted as such Eo-Oligocene thrusts (1). The major part of the alpine metamorphic recrystallization dates from this period of time.

3) during upper Oligocene and lower Miocene (fig; 1b), the internal areas of the CPK massifs, previously emerged and eroded, were flooded and overlain by the "Oligo-Miocène kabylo-péloritain" formation. Tilted blocks are associated to this distensive stage of collapse. The denudation of areas of the CPK and Sardinia channel basement during this time is dated using the fission-track method (2). The extensional shear zones in the Aspromonte basement, dated at 20-25 Ma (3), are related to this stage of distension. We assume that some low-dipping reflectors visible on the seismic cross-section of the Sardinia Channel may be interpreted as upper Oligocene - lower Miocene detachments. Thus the CPK massifs would have been separated from Sardinia since Upper Oligocene, by the opening of the eastern end of the North Algerian basin. The Oligo-Miocene basin, acting as back-arc basin, deepened and enlarged up to the lower Burdigalian. Its southern border was made by islands of "Dorsale calcaire" which separated it from the coeval Numidian trough, probably partially inherited of the Maghrebian basin.

4) during the upper Burdigalian, olistostromes and gravity-driven nappes glided northward into the Oligo-Miocene Basin cfig; 1c). They are made of flyschs and marls coming from the Maghrebian basin, the Numidian trough and the African margin. This movement requires a large uplift at the front of the internal zones, which was possibly induced by blocking of the subduction.



5) andesites of the Cornacya Seamount, including xenoliths of lamprophyres, were dated at 12.6 Ma using the $^{40}Ar/^{39}Ar$ method (fig; 1d). They correspond to the earlier stage of opening of the back-arc Tyrrhenian Sea.

6) this opening dislocated the eastern part of the Maghrebide Chain, carrying the Calabrian-Peloritan block far away from Sardinia and Kabylia. The basement of the Sardinia channel remained connected to the Sardinia block, but it suffered a new extension (fig; 1e). Datations using fission-tracks in apatite prove that the scarps of the Sardinian Valley and of the Cornaglia basin were formed between 10 and 8 Ma.

References

1 - Tricart P., Torelli L., Argnani A., Rekhiss F. and Zitellini N., 1994. Extensional collapse related to compressional uplift in the Alpine Chain off northern Tunisia (Central Mediterranean). *Tectonophysics,* 238: 317-329.

2 - Thomson S. N., 1994. Fission track analysis of the crystalline basement rocks of the Calabrian Arc, southern Italy: Evidence of Oligo-Miocene late-orogenic extension and erosion. *Tectonophysics,* 238: 331-352.

3 - Platt J. P. and Compagnoni R., 1990. Alpine ductile deformation and metamorphism in a Calabrian basement nappe (Aspromonte, south Italy). *Eclogae geol. Helv.*, 83/1: 41-58.