

Cogne diorite geological knowledge (1894-Present): the subduction factory

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The geology of the Cogne region (Valle d'Aosta, Italy) impelled the first known use of the word "subduction" around 1949. The word was forged in French first, by the Swiss citizen André Amstutz, as later acknowledged in English [1], in order to explain the Alpine structural setting of the pre-Alpine Cogne diorite pluton. The notion of subduction has met a wealth of applications since, however the Alpine structure of this quartz diorite body is still debated: was it subducted toward the NW or toward the SW? Here I try to retrace the source of the debate. Amstutz [2] presented his subduction as an alternative explanation to the then famous model of Émile Argand.

The pluton, diagnosed as a quartz diorite by Novarese [3], was first mapped during the early 1900's by the Italian Geological Survey [4]. It was an important piece of Argand's edifice [5]. Argand considered the diorite as forming the hinge of a major fold, probably based on the presence of roughly symmetrical rims. The diorite occupies the axial position. It was mapped as encircled by black schists, constituting the host-rocks for the diorite intrusive, that were viewed [4] as Upper Carboniferous sediments, in turn suggesting a Permocarboniferous age for the diorite emplacement. The so-called black schists are succeeded to the NW and to the SE by symmetrical-looking outcrops of Triassic-looking limestone, dolomite and gypsum, themselves succeeded on both sides by "calcescisti" of then presumed Liassic age. The axial plane of the structure dips to the N-NW, i.e. toward the external zones of the Alps. Argand [5] termed it "pli en retour du Valsavaranche" (= Savara Valley backfold), seeing there a confirmation of his structural model of the Alps, namely a huge pile of nappes emplaced northwestwards, secondarily backfolded toward the SE.

Amstutz defended an inverse scenario, posing the SE-vergence as the early one and the NW-vergence as the late one. This idea was also argued by Rod [6] and Caby [7].

Present-day conceptions are well exemplified by Bucher et al. [8]. The diorite is seen as partly engaged into the hinge of a mega-syncline that would possess a flat-lying axial plane. Exhumation-related, vertical shortening would be the driving mechanism. It must be added to this latest model that (1) the axial plane envisioned by Argand has now moved, running WNW, instead of SW previously (2) pre-Alpine lithostratigraphical and/or geochronological data [9] for the protoliths are no better accounted for by this model than by Argand's vision.

I suggest that the Cogne diorite has not been studied enough for itself. Deciphering its magmatic emplacement geometry and better assessing the age of its host-rocks are prerequisites before any valid structural model can be proposed, especially for the Alpine folding possibly endured by the pluton.

REFERENCES. – [1] White DA et al., Geol Soc Am Bull 1970, 81: 3431-3432 – [2] Amstutz A, Arch Sci Genève 1962, 15: 1-104 – [3] Novarese V, Boll R Com geol It 1894, 3: 275-301 – [4] Novarese V, Boll R Com geol It 1909, 40: 497-525 – [5] Argand E, Bull Soc Vaud Sci Nat 1912, 48: 20-22 – [6] Rod E, Eclog geol Helv 1977, 70: 237-242 – [7] Caby R, Eclog geol Helv 1996, 89: 229-267 – [8] Bucher S et al., Eclog geol Helv 2004, 97: 321-345 – [9] Guillot F & JM Bertrand, companion abstract.