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THE TRANSALP SEISMIC PROFILE: REMARKS AND INTERPRETATIONS FROM THE ITALIAN SIDE

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The Present structure of the Eastern Alps orogenic chain was mainly originated during their post collisional evolution which enhanced the intense difference between the Europe-N-vergent nappe thick stack of the Northern tectonic edifice and the contrasting Africa-S-vergent thrust belt of the Southern Alps. The Periadriatic Lineament corresponds to the strong structural divide of these two parts of the Eastern Alps (EA). The N vergent nappe stack of the EA originated during pre-collisional (Late Cretaceous-Paleocene) and collisional (early to middle Eocene) evolution. The N- and S-vergent thrust belts along both border sides of the EA, overrode the Oligocene-Neogene clastics of the Molasse (mostly Chattian- Tortonian) and are expression of the post-collisional, neo-Alpine evolution of the EA. The post Tortonian evolution occurred only to the S, and strongly affected the Montello kilometric Messinian deposits up to the overlying Pliocene marine cover

(Cornuda), along the external strongly deformed structural belts of the Venetian Plain N border. These Late Neogene to Pleistocene tectonic deformations are consistent with the Adria Micro-Plate motion to the NW for some 15-20 km in amplitude, as documented by field structural analysis (CASTELLARIN et al.,1998). Thus, the EA neo-Alpine evolution occurred according to out of sequence opposite stuctural accretion along the N and S borders of the orogenic chain.

With regards to the buried crustal and lithospheric setting reconstruction, the deep seismic reflexion data along the Transalp Profile (TsAP) show a prominent major seismic break beneath the belt, roughly interposed between the Periadriatic (or Insubric) lineament (PL) and the southern surfacial limit of Alpine metamorphism (SAM). The break substantiates at depth the sharp surface limit between the Alps (Europe-vergent nappe stack) and the Southern Alps which is evident in the geological maps (BIGI et al., 1990) and at the surface, where the PL dips always to the N along the Pustertal with strong backthrusting of the Austroalpine units over the Southern Alps sequence (DAL PIAZ, 1934). The most important intrusive bodies crossed by the Transalp Profile are the eastern tail of the Lower Permian Brixen granite and the Oligocene (30 Ma) Rieserferner tonalite (BIGI et al.,1990). The block to the N of the IL (Penninic wedge) is less reflective and locally transparent. These features are probably related to the still soft behavior at depth of the nappe stack and the subvertical to high angle attidute of major internal discontinuities. The Penninic wedge corresponds to the Penninic nappe stack exposed in the Tauern window (TW), consisting of gneissic granitoids

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(Zentral Gneis), pre-granitic basement and Permian-Mesozoic cover metasediments, capped by the ophiolitic Glockner nappe, exposed as two huge antiformal belts (e.g., LAMMERER & WEGER, 1998).These continental and oceanic units underwent intense N-S shortening and vertical extrusion, coupled with orogen-parallel extension and tectonic denudation of the Austroalpine orogenic lid (BEHRMANN, 1988; FÜGENSCHUH *et* al., 1998; CHRISTENSEN et al.,1994). Exhumation of 30-35 km in the last 40 Ma (mostly between 20 and 15 Ma, *i.e.,* in early-mid Miocene times) is documented by the 10 kb decompressional P-T path evolution recognized in the same interval (VON BLANKENBURG et al., 1989; etc.). Furthermore, the European Moho, along the Profile, dips regularly to the S attaining the zone below the N side of the TW. Consequently, ductile deformation and uplift of the TW structure are, very likely, representative of intra-crustal extrusion processes confined to the colliding orogenic wedge. To the S of the IL, unlike the TW, the Dolomite area underwent only moderate uplift (about 3-4 km) as documented by the outcropping low grade metamorphic basement and its Permo-Triassic non-metamorphic cover, located close to the IL (Plan de Corones) and by fission track studies. Furthermore, the block to the S of the PL is more reflective and is composed by a stack of strongly laminated, thick subunits mid angle dipping to the S and well marked from about 25 up to about 10 km. The laminated subunits are sharply interrupted by smooth, lobed up to rounded transparent zones beneath and close the PL from about 5 to 25 km depth. These seismic stuctures may be interpreted as intrusive bodies of Permian and/or Oligocene age as the bodies largely outcropping in the surrounding of the profile (BIGI et al., 1990) which can be referred to the E and W continuation in depth respectively of the Brixen Permian batholith and of the the Oligocene Rieserferner pluton. The contiguous reflective laminated subunits may be related to pre-granitic mafic interleavings and/or cumulus gabbro-ultramafic bodies and their possible pre-Alpine tectonic duplications along ductile shear zones, which may be interpreted as Hercynian (or older) lower crustal zones of the Southern Alps, dragged and upwarped by the Alpine extrusion of the TW structure.

In this frame, the N-dipping break zone beneath the PL can be interpreted as the N edge of the Adriatic indenter against the overturned rear of the Alpine orogenic wedge, a mantle-free float belt of continental and oceanic units above the subducted European lower plate. This northward protrusion of Adriatic lithosphere explains the exhumation of the TW Penninic wedge by **ductile extrusion** mechanisms. The structure and geometries of the Adriatic indenter are similar to those predicted by ARGAND (1924) and more recently recognised in the Western and Central Alps (ECORS-CROP and NFP20 Profiles, see from ROURE et al.,1990 onward). Wedge indentation by the Adriatic lithosphere is consistent with the upper crustal thrust belt of the Dolomites and, in general, of the eastern Southern Alps, which can be considered as the tectonic stack to the S of the decoupled upper crust, supplied by the underlying lower crust and lithospheric mantle during their indentation to the N. The shortening of some 40 km recorded across the Southalpine thrust system is consistent with the amount of the indentation to the N, shown by the seismic image, for a similar amplitude, under the TW structure. Finally, the relevance of the Adriatic indenter points to the late post collisional change in the tectonic growth of the EA orogenic chain. In fact, from the late Miocene (Messinian) onward, the tectonic accretion was transfered from the N frontal zones of the Alps to the S vergent thrust belt of the Southern Alps as a consequence of the deep underthrusting of the Adriatic lithosphere and of its further indentation to the N.

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