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Cratonic keels and a two-layer mantle tested: mantle expulsion during Arabia-Russia closure linked to westward enlargement of the Black Sea, formation of the Western Alps and subduction of the Tyrrhenian (not the Ionian) Sea.

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Two of the most controversial questions concerning mantle behaviour are the great depth of cratonic tectospheric keels (e.g. [1, 2]) and whether the base of the upper mantle is a substantial barrier to flow [3]. Individually the arguments for each are indecisive but if both are true there should be major dynamical consequences for plate motions, susceptible to direct observation [4]. If keels extend nearly to 660km the principal considerations are: Where does the mantle come from to put beneath a widening ocean? and Where does it go when two cratons approach one another? The former, in an Atlantic-Arctic context, was explored in [4]; here we explore the latter in an Alpide belt setting.

My recent studies show that the Western Alps were primarily the result of ~250km westward motion of northern Adria/Italy in the early Oligocene, using a formerly-straight Insubric-Pusteria-Gailtal fault-Line, before the Giudicaria NE-ward offset differentially compressed the Eastern Alps. This dextral motion is recorded in a shear zone extending all the way to the Black Sea coast in the Dobruja area, north of the probably Neo-Archaean Moesian block, well known for its (W-ward) 'indenter' behaviour, and it may explain the present deep seismicity below the SE Carpathians. Westward flow of mantle from between the converging Arabian and Russian tectospheres has evidently driven this motion by impinging upon the cratonic keel of Moesia, opening the western Black Sea.

This westward motion of the entire Balkan Peninsula appears to have built the Apennines. Their previous history is probably this. The crust of the former westward-extending 'Greater Italy' was extensively undercut by basal subduction tectonic erosion in the early-mid Cretaceous, creating a flat-slab interface with its downbend near the present coastline. Subduction then ceased and the undercut region subsided (recorded in Apennine stratigraphy) as the underlying ocean floor cooled until Oligocene. Initial closure of the proto-Tyrrhenian Sea by Corsica-Sardinia established a west-dipping vergence which was imposed upon the undercut 'Italian' margin as closure continued. This pushed the now-cool underlying oceanic plate past the former downbend, establishing slab pull which has pulled open parts of the Tyrrhenian floor. Thus the easterly vergence of the Apennine front is *not* due to subduction of Apulia-Ionian Sea. Rather, the Tyrrhenian floor plate must downbend sharply beneath the narrow fault-bounded Gioia (marginal) Basin, doubling back westward beneath itself to bring the subducted crust into suitable position for sourcing the Aeolian arc. This doubling-back is attributable to the westward mantle flow developed further East.

[1] Gu, Dziewonski & Agee (1998) EPSL **157** ; [2] Agee (1998) Rev. Mineral. **37** ; [3] Osmaston, IUGG2003; [4] Osmaston (2006) *in* ICAM IV, OCS Study MMS 2006-003, p.105-124. Also:- http://www.mms.gov/alaska/icam.

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