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Pacific-style Basal Subduction Tectonic Erosion (STE): Essential Precursor to Construction of the Alps/Carpathians.

Miles F Osmaston (The White Cottage, Sendmarsh, Ripley, Woking, Surrey GU23 6JT, UK;
t: +44-1483-224138; e-mail: miles@osmaston.demon.co.uk)

Seismicity in the downbends of subducting plates favours a through-plate step-faulting downbend process, escalator-like, seen to begin at outer trench slopes. Efficient basal STE of the upper plate results, whereby each step-throw increment entraps and then removes a sliver of hanging-wall material, advancing the downbend beneath the upper plate. Such downbend advance can be tracked geologically, e.g.:- (1) off NE Japan, late Oligocene ~200km westward; (2) both Andean 'flat-slab' sectors, 300km+ in the past 10Ma (now totals ~650km) and continued rapid advance is here preventing the establishment of arc-type volcanism at the surface. Steepening of the downbend angle, a feature of the STE model, is evident. Off NE New Zealand, early Miocene imbrication of the Hikurangi continental margin was evidently a sequel to extensive Cretaceous(?) undercutting by STE. The downbend is still 300km from the 'trench'. Some of the sliced-up margin may have been carried down and lodged across the steepened downbend and some may source the current ignimbritic volcanism.

Application of these findings to the Alps yields the following outline. During early Cretaceous the N margin of the S Alpine plate, from the Western Alps to Transylvania, was extensively (600km?) rapidly undercut to the SE and then S by STE. A belt of oceanic crust lay between the trench and the continental shelf. The Canavese-Insubric-Giudicaria-Gailtal line marks the final downbend positions. Imbrication and stacking of this margin began in the mid-Cretaceous, increasing in severity westwards, where slices were carried down and lodged across the down bend, to form a wedge of crustal material against the steep hanging wall and reaching to ~150km depth. This wedge, differentially exhumed, now comprises the Penninic nappes, the stacking order having reversed the palaeogeographic order (Piemont ophiolites came from the N edge of the undercut margin).

Collisional evolution was grossly affected, along the chain, by the nature of the European margin encountered. In the W, fully continental crust was overridden, and the external massifs rose soon after being overthrust, blocking further north-vergent surface closure. At the Carpathian-Pannonian end, imbrication of the undercut southern margin was minimal because the crust overridden was mostly oceanic and young, its high temperature causing widespread early Miocene rhyolitic volcanism from the buried crust, and its continued heat loss causing the Pannonian Basin subsidence.