My Ref.Meetabst/IASP97A2.sam/pdf

IASPEI 1997, 29th General Assembly of IASPEI,Thessaloniki, Greece, 18-28 Aug. 1997.

Symposium S3 "Geodynamics of the Alpine-Mediterranean Collision Zone", Abstracts p.26

Mechanism of Subduction Downbend as the Cause of Island Arc Curvature and Back-arc Opening: Application to the Hellenic Arc and Cretan Sea and the Reconstruction of the Hellenide Orogen.

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

Subduction downbend constitutes a rolling hinge moving across the oceanic plate. The continuing expulsion, from the hinge, of material from the lower, viscous part of the plate sets up a vertical excess pressure gradient which can support outer rises without elastic flexural contribution (Melosh 1977, 1980). A step-faulting mode of downbend, with quasi-cylindrical fault planes, is favoured by seismicity aspects and the ability to provide subduction tectonic erosion of the overriding plate (see companion paper).

The world's highest outer rise (~1km) occurs in the Arica Bight, central Andean margin, where two-way 'flexure' of the plate restricts the expulsion of the hinge material. Seismic anisotropy for huge distances along strike from this downbend suggests horizontal shearing escape of this material along strike in each direction from the Bight (Silver 1995). Conversely, there is no outer rise at the Mariana arc, where the oldest known oceanic plate is undergoing downbend. It appears that the bowing of the arc, and the related opening and northward propagation of the Mariana Trough at the rear, is due, not mainly to slab pull, but is a relieving response to the along-downbend distensive pressure developed in the lower part of the subducting plate. A similar mechanism may cause the bowing of island arcs generally.

The Hellenide Orogen represents the closure of the 'Pindos-Gavrovo Ocean' by thrusting onto Apulia. As the Hellenic Arc encompasses some of Apulia its formation must be post-Hellenide. The plate being subducted at the Hellenic Trench is probably >200Ma old, so Mariana-type features may occur. The deep Cretan Sea basin, with Messinian salt, now separates the exhumed Hellenide ultra-HP metamorphic slices of the Cyclades from HP ones on Crete. Reconstruction of this part of the Hellenides suggests post-Hellenide CW rotation of the Peloponnesus about a Gulf of Patras pole, opening of the Gulf of Corinth, Corinth Isthmus extensions, and related opening of the Cretan Sea, heat from which likely enhanced the UHP exhumation. The resulting Hellenide Orogen bears similarities to the western Alps and invites a similar synthesis (see companion contribution). Indeed, if the Aegean Sea underwent complex major E-W post-Hellenide extension, before the Cretan-Corinth movement, an even closer similarity is achieved. Timings will be suggested.