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Evidence for the tectonic development and subduction-exhumation of a Palaeozoic-Mesozoic continental margin in the westernmost Anatolides, W Turkey

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The Anatolide regional tectonic unit comprising the Tavşanlı Zone and its lower-grade equivalent further south (Afyon Zone) represents one of the world's best examples of a subducted, then rapidly exhumed continental margin. Additional to the well-documented Mesozoic succession, a Palaeozoic "basement" has now been discovered in the westernmost Anatolides (northwest of Dursunbey). The blueschist facies exposure (∼50 km2) is characterised by a mainly S-dipping foliation and S-plunging mineral stretching lineation on the main foliation surface. In contrast, further northeast in the Tavşanlı Zone the main foliation dips gently northwards and the mineral lineation trends east-west. The lowest unit in the study area ("basement") is made up of finely banded, dark grey schists, intercalated with metabasic rocks (∼600 m-thick). Graphitic layers occur near the base and thin (<25 cm) metaquartzite intercalations above. The "basement" is cut by a foliated metagranite intrusion (∼1 km2) associated with metarhyolite flows (< 10 m thick). Ion microprobe U-Pb dating of zircons separated from the metagranite yielded an inferred crystallisation age of 445.8 ± 8.0 Ma. The country rock schists are overlain, above a possible unconformity, by paler coloured schists with metabasite lenses, followed by thick-bedded, to massive meta-carbonates (>1300 m). The uppermost levels of the carbonate platform are relatively thin bedded (5 cm-1 m thick) and chert rich. A HP/LT mineral assemblage in both "basement" and "cover" units includes sodic pyroxene, sodic amphibole, lawsonite, chloritoid, phengite and quartz, also minor tourmaline, apatite, rutile and graphite. The rare co-existence of sodic pyroxene and chloritoid indicates that metamorphic conditions in this region reached P>18 kbar and T<400-580˚C. The intercalated metabasites contain lawsonite and sodic amphibole with minor calcite and quartz; the metagranite has sodic pyroxene, chloritoid, phengite and quartz, while the metarhyolites contain sodic pyroxene, feldspar, quartz and white mica. The presence of a common mineral assemblage shows that the entire Palaeozoic-Mesozoic succession underwent similar HP/LT metamorphism. Microstructures seen in orientated thin sections indicate at least three deformation phases. The blueschist minerals crystallised within an already folded cleavage (D1 & D2), and are enveloped by the main foliation (D3) that formed after peak metamorphism (probably exhumation related). A melange follows directly above the platform in the west of the area, whereas in the east the platform is cut out by a low-angle extensional fault (probably also exhumation-related), so that the melange there lies directly on "basement" schists. Blocks in the melange include meta-basalt, meta-gabbro, meta-chert and meta-carbonate rocks. The matrix of the melange locally includes glaucophane and lawsonite, but generally exhibits lower-grade blueschist metamorphism. Supported by new geochronological, geochemical and microprobe data (from the School of GeoSciences, University of Edinburgh), the succession as a whole can be interpreted as a continental basement affected by latest Ordovician magmatism. After a possible unconformity, rift-related (?) siliciclastic sediments with basaltic intercalations were covered by a carbonate platform that can be related to rifting and subsidence of the northern margin of the Anatolide continent. The platform collapsed during Late Cretaceous time related to regional southward emplacement of over-riding accretionary melange and supra-subduction zone-type ophiolites. The continental margin was regionally exhumed by Palaeocene time, followed by further compressional deformation during Mid-Eocene final closure of Izmir-Ankara ocean (“N Neotetethys”).