Paper Number: 2260

High-pressure metamorphism of subducted passive continental margins: Tavsanli Zone in Turkey and Oman

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The Tavsanli Zone in northwest Turkey provides one of the best examples of continental crust subducted to a depth of 80 km and exhumed, while preserving to a large extent the prograde high-pressure - low-temperature (HP/LT) mineral assemblages. The Tavsanli Zone consists mainly of a passive continental margin sequence of Triassic to Cretaceous sedimentary rocks, which have undergone metamorphism at ~24 kbar pressure and 430-500 °C temperature during the Late Cretaceous (~80 Ma). The continental blueschist facies sequences are tectonically overlain by an oceanic accretionary complex (ophiolitic mélange) of basalt, chert, pelagic shale and limestone, which shows only an incipient blueschist facies metamorphism. Farther up in the tectonic stack is an ophiolite, which at present is represented mainly of peridotite (>%90) with minor gabbro and pyroxenite all cut by isolated diabase dykes. Although ophiolite outcrops are isolated at present, most likely they were once part of a very extensive Anatolian ophiolite emplaced over the Anatolide-Tauride Block during the Cenomanian/Turonian. All these tectonic units are intruded by Lower to Middle Eocene granodiorites, and are overlain by Lower Eocene marine limestones. The generation of blueschists is related to the burial of the northern margin of the Anatolide-Tauride Block in an intra-oceanic subduction zone during the Campanian; the blueschists were exhumed during the ongoing subduction and prior to Paleocene continental collision through a thrust fault at the base and a normal fault at the top.

The Tavsanli Zone shows similarities to the Semail ophiolite and the underlying HP/LT metamorphic rocks in terms of tectonic setting, geological evolution and in the timing of the deformational and metamorphic events. The Semail ophiolite has a length of over 400 km and a width of 150 km, its thickness prior to emplacement is thought to be 15-20 km; the thickest part of the ophiolitic sequence (8-12 km) is made up of peridotites. The zircon ages from the plagiogranites of the Semail ophiolite (95.4-94.5 my) and the radiolarian ages from the cherts overlying the ophiolite show that the Semail ophiolite is Cenomanian in age. The ~93.5 Ma hornblende Ar-Ar ages from the subophiolite metamorphic rocks show that within 2 my following the formation of the Semail ophiolite at a mid-ocean ridge, it was emplaced, probably along a transform fault, over the neighbouring oceanic crust. The Ar-Ar ages from the base of the Anatolian Ophiolite are also in the range of 95-90 Ma. The Semail ophiolite was first emplaced over an oceanic crust and then over the continental margin of Arabia. During its emplacement over the Arabia margin, it bulldozed the continental margin sequences in its front. These continental margin sequences, which crop out southwest of the Semail ophiolite, are known as the Hawasina nappes and show close similarities to the Lycian Nappes in the Taurides. The Arabian continental crust under the Semail ophiolite underwent HP/LT metamorphism during the Campanian (82-79 my), which is of the same age as the HP/LT metamorphism in the Tavsanli Zone. The blueschists and eclogites under the Semail ophiolite are unconformably overlain by the marine Eocene deposits, as in the Tavsanli Zone. The main difference between the Tavsanli Zone and Oman is that in the Tavsanli Zone the ophiolite emplacement was followed by the continent-continent collision, whereas no continental collision has occurred in Oman, where Indian ocean lies north of the Semail

ophiolite. Another difference is that the Semail ophiolite is thrust over the Arabian platform, whereas the Anatolian ophiolite over the Anatolide-Tauride Block, a relatively small terrane, which has rifted off from Arabia during the Triassic.