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Subduction-related metamorphism beneath ophiolites (Oman) and during early stages of continental collision (Himalaya)

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Subduction-related metamorphism occurs beneath ophiolites (Oman), beneath island arcs (Kohistan) and during the early stages of continental collision (Kaghan, Tso Morari; Himalaya). Ophiolite obduction necessarily involves subduction of first oceanic, then continental crust to mantle depths beneath the ophiolite. In Oman an inverted pressure and temperature profile is exposed beneath the Semail ophiolite from garnet+clinopyroxene-bearing granulite to hornblende+plagioclase amphibolite down through epidote amphibolite and a variety of greenschist facies meta-sediments, dominantly cherts, marbles and quartzites. Thermobarometry on Grt+Cpx-bearing amphibolites immediately beneath the contact with mantle sequence harzburgites shows that the upper sole rocks formed at PT conditions of 770-900°C and 11-13 kbar, equivalent to depths of 30-40 km in oceanic lithosphere. Heat for metamorphism can only have been derived from the overlying mantle peridotites. Pressures are higher than can be accounted for by the thickness of the preserved ophiolite (15-20 km). Timing of peak metamorphism was synchronous with formation of the ophiolite gabbroic – trondhjemite crustal sequence and eruption of the pillow lavas (Cenomanian; 96-95 Ma). During the later stages of obduction the continental margin was dragged down to depths of nearly 100 km and basaltic sills within calc-schists were converted to eclogites (20-25 kbar; 500-560oC; 79.1 Ma), then exhumed back up the same subduction channel. Apparent 'extensional' fabrics throughout the HP units are related to upward flow of deeply buried rocks in a wholly compressional environment. Eclogites in a similar structural position occur along the Himalaya in the northernmost exposures of Indian plate rocks. These eclogites formed either during the latest stage of ophiolite obduction or the earliest stage of continental collision.