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Deciphering the Variscan orogeny: HP metamorphism at different temperatures and HT metamorphism at different pressures.

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The European Variscan belt is well known for its voluminous granites and widespread migmatite complexes. However, the same short orogenic episode also resulted in the formation of blueschists and numerous bodies of eclogite. The picture is further complicated by large bodies of felsic granulite (including the type locality for granulite), pods and lenses of mantle-derived garnet peridotite and, since the beginning of the 20th century, also ultra-high pressure coesite and/or microdiamond-bearing rocks. How can all these apparently different rocks be created in a single orogen and be exposed so soon after the tectonometamorphic events (as revealed from post-orogenic conglomerates and sedimentary sequences) in such close proximity? The answer lies in deciphering critical rock types through microanalysis of major and trace elements as well as isotopes. The garnet peridotites, sometimes enclosing mantle-type eclogite lenses, occur together with the felsic granulites. Detailed investigation has revealed that these K-feldspar+quartz- rich rocks with minor garnet, kyanite and rutile formed at eclogite facies conditions. Recent studies have confirmed microdiamond and coesite in such so-called granulites thus confirming UHP conditions i.e. the crustal rocks have been subducted to mantle depths and trapped slices of mantle during their exhumation. Geochronological and diffusion studies have determined a rapid exhumation of these units. These are not the only HP rocks, however. An earlier phase of subduction and exhumation produced eclogites that were in a hanging wall position before exhumation of the hot granulite-peridotite units. Further away from the final subduction zone the exhuming hot granulite-peridotite bodies flowed to underplate the crust. Locally, these hot complexes domed upwards and became caught-up and flattened-out in mid- to upper-crustal shear zones. Where such complexes are exposed today they are bounded by units representing middle and lower crust, locally containing a 3rd type of eclogite in places together with spinel peridotite. Eclogites in this situation can show a pyroxene-hornfels overprint (olivine-bearing textures) despite preserving omphacite (from the eclogite facies stage) as well as granulite and amphibolite facies breakdown textures. With the realisation that the eclogites are from different stages of the subduction-collision history, as deduced by detailed investigation of suitable key samples by multiple microanalytical methods, it is now possible to piece together this most enigmatic orogenic belt. Is this type of relamination of upper crustal material to the lower crust an example of what is happening in the Himalaya today?

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