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Exhumation of an unusually large, $\sim$3000 km^3 coherent block of oceanic crust from >40 km depth

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The Central Metamorphic terrane (CMt) is an unusually large ($\sim$3000 km^3) coherent block of mid-ocean ridge (MOR) metabasites; the first one of this scale reported with eclogite facies relicts, decompression assemblages, and thermobarometry indicating exhumation of the entire block from >40 km depth. The CMt is exposed in the eastern Klamath Mountains of northern California and is dominantly an amphibolite facies metabasite which represents remnant oceanic crust subducted in a mid-Paleozoic Pacific-type margin. Thermochronology indicates that the CMt was subsequently exhumed along the Trinity fault during an early Permian extensional event. Newly discovered relict textures with new thermobarometry results suggest the CMt metabasites record the retrograde segment of the P-T-deformation-time path during exhumation from hornblende eclogite facies P-T conditions. A decompression and cooling sequence consisting of rutile cores within ilmenite crystals mantled by titanite is observed in CMt amphibolite samples. Zr-in-rutile thermometry combined with experimental data for rutile stability in metabasites suggests that relict rutile crystals preserve early P-T conditions of $\sim$600˚C and >1.3 GPa. Transition from eclogite facies is further supported by ilmenite-plagioclase-amphibole symplectites suggesting replacement of garnet or omphacite during decompression. The dominant mineral assemblages and metamorphic fabrics indicate dynamic recrystallization of metabasites during declining P-T conditions through amphibolite $\rightarrow$ epidote amphibolite facies. Exhumation via extension along the Trinity fault is suggested by the coplanar relationship between metabasite decompression-related deformation fabrics and the Trinity fault. We propose that subducted oceanic crust (CMt) was subsequently exhumed as a large coherent block from depths >40 km. This is significant because the conversion of mafic oceanic crust to eclogite produces the negative buoyancy (relative to mantle peridotite) that drives subduction. Exhumed HP and UHP terranes are dominantly low density material, either sialic crustal material or serpentinite, with high density metabasite typically representing only about 15% exhumed terranes. Exhumed metabasite generally occurs either as meter-scale blocks in shaley mélange or as kilometer-scale sheets in serpentinite. The largest masses of exhumed eclogitic metabasite are found in Alpine massifs preserved as sheets ($\sim$1 km by 10-20 km, <50 km^3) enclosed in serpentinite. Such observations point to the importance of positive buoyancy in the exhumation process of HP and UHP metamorphic terranes at convergent margins. The CMt is significant because the exhumation of such a large block (1 to 5 km thick, $\sim$15 km wide by $\sim$80 km long, $\sim$3000 km^3) of metabasite from eclogite facies conditions has not been previously reported and the lack of associated low density material of a similar age presents a dilemma for buoyancy driven exhumation models.