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Paleo-asperities frozen along a major fault zone in Alpine Corsica ophiolites: Implications on present-day subduction zone intermediate-depth seismicity

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In an ophiolitic thrust sheet of Alpine Corsica, a major fault zone called PHI2 separates oceanic gabbros from variably serpentinized peridotites. Along and near PHI2, abundant pseudotachylytes testify to ancient seismic ruptures. A mineralogical and structural analysis of the pseudotachylyte veins shows that seismic ruptures occurred at various stages before, during or after the subduction process.
Due to the lack of index minerals, P-T conditions of formation of peridotite-hosted pseudotachylyte remain undetermined. Conversely, two populations of gabbro-hosted pseudotachylyte veins can be distinguished: veins formed under blueschist to eclogite facies conditions (containing glaucophane and omphacite) and veins formed under greenschist facies conditions (containing tremolite, clinochlore and clinozoisite). Various kinematic indicators show that the blueschist to eclogite facies pseudotachylyte veins formed within the subducting Piemonte-Liguria oceanic lithosphere at depths of about 60 km, while the greenschist facies veins formed during syn- to post-collisional crustal extension.
Detailed mapping indicates that the internal structure of PHI2 fault zone is spatially heterogeneous. A-type damage zones, which are located between gabbro and fresh (not serpentinized) peridotite, are characterized by pseudotachylyte accumulations and are interpreted as ancient fully locked asperities. To the opposite, type C damage zones, observed between gabbro and fully serpentinized peridotites, are characterized by the lack of pseudotachylytes and the presence of cataclasite and mineralized veins, and are regarded as creeping, aseismic, domains. B type damage zones, found between gabbro and moderately serpentinized peridotites, are outlined by pseudotachylytes, but in significantly less amounts than along A-type zones. These zones, intermediate between the other two types, could correspond to partially locked (conditionally stable) portions of the fault zone.
The distribution of mechanical heterogeneities is tentatively explained by contrast in friction properties of the various rock interfaces and is compared with similar cases reported from the Alps or other convergent settings.