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The generation of the unique geodynamics and petrology of oceanic core complexes through crustal subduction and serpentinite diapirism

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Oceanic core complexes are seafloor terrains located at several intersections of slow spreading ridges and fracture zones, which are characterized by abundant occurrences of serpentinites and peridotites, as well as the distribution of other metamorphic and magmatic lithologies. These lithological assemblages are anomalous in the oceanic terrain where basalt and gabbro predominate. Trying to explain the phenomenon without resorting to dubious detachment faulting, analog structural models were applied, based on the partial similarities between oceanic and metamorphic core complexes, where the latter are associated with subduction, remineralization and subsequent diapiric ascent.
Some analog and numeric structural modeling suggest that subduction would start where two lithospheric slabs of distinct density contrast were juxtaposed, and its continuation depends on remineralization that would increase the density of some crustal components, and secrete the lighter remineralized fraction. The resulting tectonic processes that were generated by differential gravity, caused the denser slab to glided underneath the lighter one. The models emphasized that the differences between collisional and extensional styles of subduction resulted from variable rates of friction between the slabs. These findings could decipher the enigmatic geodynamic setting of oceanic core complexes, because in domains of the very steep thermal gradients and abundant availability of water, across a vertical weakness zone, the denser slab would possibly subduct vertically and undergo first serpentinization and then peridotitization at shallow depths. The serpentinites could then ascend diapirically to exhume near the ridge – fracture zone junction, bearing embedded segments of peridotites, which jointly depict the lithology of oceanic core complexes.