What MORB Left Behind – the Lower Ocean Crust at Slower Spreading Ridges

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The classic model for the ocean crust of pillow lavas, dikes, and gabbros that range downward from evolved isotropic to primitive layered overlying mantle tectonite does not fit well into current observations at slow and ultraslow spreading ridges of gabbros mapped and drilled at different locations in the Indian and Atlantic Oceans. In many locations, not only are gabbroic rocks rare, but the entire crustal section may be missing, with mantle tectonite exposed directly to the seafloor. Elsewhere, the crust may consist of lavas overlying mantle peridotite cut by basaltic dikes, with only rare occurrences of gabbro. At many locations, relatively large 5-10 km wide bodies may be emplaced beneath a carapace of dikes and lavas, with the dikes and lavas extending far beyond the principle magmatic center to intrude and erupt over the mantle, while finally large gabbro massifs such as the Atlantis Bank oceanic core complex may extend over areas as much as 400-km2, once overlain by sheeted dikes and pillow lava sequences as envisaged by the classic ocean crust model. However internally the latter bear little resemblance to the simple sequence of more evolved isotropic gabbros overlying more primitive layered gabbros. Instead, they internal stratigraphy represents dynamic accretion, the product of on-going intrusion, deformation, compaction, and upward melt migration, creating an internal stratigraphy that bears little resemblance to on-land layered intrusions or the classic model for ocean crust. New observations, however, are beginning to show that the composition and stratigraphy of the gabbro sequences show systematic variations from the largest intrusions down the smallest, with late-stage melt migration, internal deformation, and evolved gabbros far less prominent at the latter.