ODP DISCOVERS MUD VOLCANOES FROM THE MANTLE

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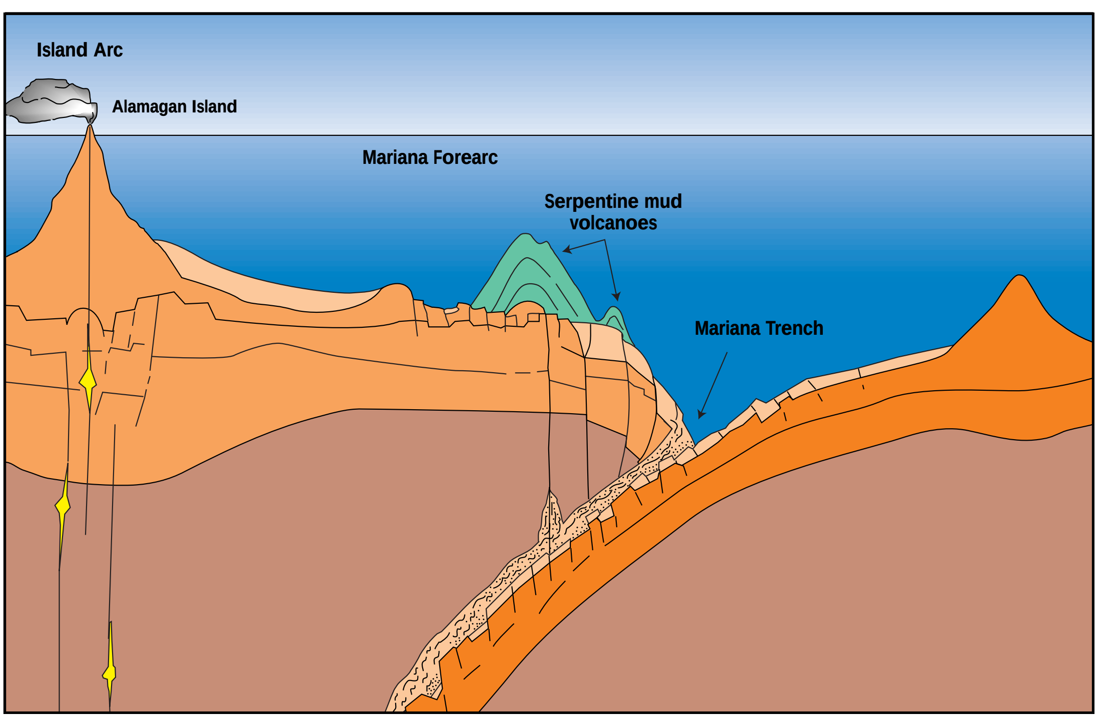
Undersea volcanoes, oozing green, asbestos-rich mud, were discovered just west of the Mariana Trench in the western Pacific. Seafloor volcanoes are normally composed of molten lava, but the unusually large (more than 25,000 m in diameter and 2,000 m high) "Conical Seamount" mud volcano was formed by gradual build up of low-temperature, fine-grained, unconsolidated serpentine flows. Serpentine, an asbestos mineral, is formed when water is mixed with rock material originating from the mantle, tens of kilometers below the seafloor. The flows carrying the serpentine and other rocks formed by chemical transformation under elevated temperatures and pressures (metamorphism), move upward to the seafloor along deeply penetrating faults that extend down to the subducting plate. Water, an essential ingredient for metamorphism of the mantle to serpentine, is squeezed from the downgoing slab and percolates upwards, due to its lower density. Our first efforts to sample this volcano, to learn more about its origin, involved shipboard dredging of rocks and muds from the volcano's surface. Sonar imaging of the seafloor indicated large flows, and submarine investigation proved these to be composed of serpentine muds. However, drilling was required to truly understand the internal mechanics of Conical Seamount, and the origin of the fluid. With these goals in mind, ODP Leg 125 penetrated the summit and flanks of the volcano in 1989 and confirmed that the entire edifice, and not just the surface, was composed of serpentine mud flows. Furthermore, drilling provided the first evidence that fluids derived from the down-going plate were actively emanating from the seamount. The composition of these fluids is unique in the world's oceans. For example they are more basic (pH of 12.6), than any ever measured from the deep ocean. ODP also recovered rock fragments in the muds that could only have formed at great depths (tens of km), most likely from the subducting plate. This observation proved that the routes for the slab-derived fluids likely penetrate to the décollement, the contact between the overriding and subducting plates. The mantle rock fragments recovered by ODP are remarkably uniform in composition. The important implications of this are that the rising fluids are will be subjected to a less complex range of chemical interactions on their journey to the seafloor than would occur in more lithologically variable regions. As such, the Mariana serpentine seamounts are an excellent place to study slab-derived fluids that are more pristine than those collected elsewhere, such as at accretionary sedimentary wedges. Scientists need to understand the fluxes and compositions of slab-derived fluids from these locations, and others world-wide, in order to determine the subduction-related contribution to global mass balance. Because these seamounts are the only serpentine mud volcanoes known to be active, they provide the optimal site for such studies.



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