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The "Plate" model for the genesis of melting anomalies

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The Plate Tectonic Processes, or "Plate" model for the genesis of melting anomalies ("hot spots") attributes them to shallow-sourced phenomena related to plate tectonics. It postulates that volcanism occurs where the lithosphere is in extension, and that the volume of melt produced is related primarily to the fertility of the source material tapped. This model is supported in general by the observation that most present-day "hot spots" erupt either on or near spreading ridges or in continental rift zones and intraplate regions observed or predicted to be extending. Ocean-island-basalt-like geochemistry is evidence for source fertility at productive melting anomalies. The melting anomalies that have been classified as "hot spots" and "hot spot tracks" exhibit extreme variability. This suggests that a "one size fits all" model to explain them, such as the classical Plume model, is inappropriate, and that local context is important. Associated vertical motion may comprise precursory-, contemporaneous- or post-emplacement uplift or subsidence. The total volume erupted ranges from trivial in the case of minor seamount chains to $\sim 10^8$ km^3 for the proposed composite Ontong Java–Manihiki–Hikurangi Plateau. Time progressions along chains ranges from extremely regular to absent. Several avenues of testing of the hypothesis are underway and are stimulating an unprecedented and healthy degree of critical debate regarding the results. Determining seismologically the physical conditions beneath melting anomalies are challenging because of problems of resolution and interpretation of velocity anomalies in terms of medium properties. Petrological approaches to determining source temperature and composition are controversial and still under development. Modeling the heat budget at large igneous provinces requires knowledge of the volume and time-scale of emplacement, which are often unclear. Although ocean-island-basalt-type geochemistry is generally agreed to be derived from recycled near-surface materials, the specifics are not yet agreed. The subject is currently at an ongoing stage of development, and poses a rich array of crucial but challenging questions that need to be addressed.