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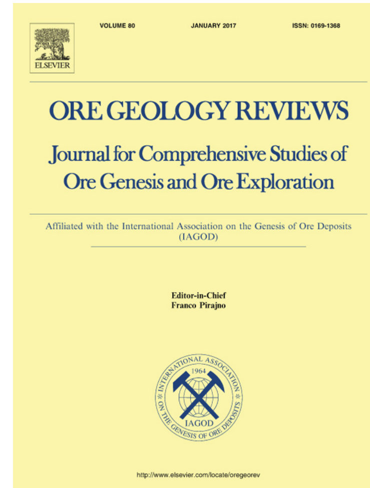

Exploring the ocean for hydrothermal venting: New techniques, new discoveries, new insights

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Exploring the ocean for hydrothermal venting: New techniques, new discoveries, new insights

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Abstract

Enumerating active hydrothermal fields on the seafloor has been a challenge since their discovery almost 40 years ago. High-temperature hydrothermal fields are readily discoverable, primarily by detecting mineral-laden plumes, but low-temperature, particle-poor vent fields resist discovery. Decades of exploration for vent fields have covered, though often cursorily, about one-third of the global lengths of both oceanic spreading ridges (OSRs) and volcanic arcs, identifying some 630 active vent fields. About 80% of these fields are on OSRs, and the spatial frequency of those fields is currently estimated as ~0.5–5/100 km, generally increasing with spreading rate. Over the last decade, however, a few detailed surveys have added sensors capable of detecting ephemeral chemical tracers (oxidation-reduction potential) in addition to standard sensors that detect quasi-conservative optical tracers (such as light backscattering). This approach has revealed a new view of the distribution of venting fields along fast-spreading (>55 mm/yr) OSRs. Studies of four such ridge sections totaling 1470 km length suggest that the present inventory of vent fields may underestimate the true global population of vent fields on fast-spreading OSRs by a factor of 3–6. This increase implies that ridge axes are unexpectedly "leaky" reservoirs, from which hydrothermal fluids escape at far more sites than presently assumed; that the supply of dissolved hydrothermal iron, which may be fertilizing the primary production of the Southern Ocean, is higher than now calculated; and that present estimates of recoverable sulfide tonnage from ridge axes may be too low. Along slow-spreading ridges, which account for 60% of the global OSR length and 86% of known sulfide tonnage, expansive axial valleys present special exploration challenges that will not be easily overcome.