Diverse hydrothermal fluid chemistries at 12–15°N, Mid-Atlantic Ridge: Irinovskoe, Semenov-2, Azhadze II and Logatchev I

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Most known/suspected seafloor hot springs (ca. 700+) likely interact with mainly basaltic or felsic oceanic crust [1]. Despite the significance of hydrothermal interactions with ultramafic substrate for astrobiology/prebiotic ocean chemistry and global geochemical cycling, comprehensive fluid chemistries are available for very few such vent systems (<10), obscuring potential diversity or commonality. Here, we present detailed fluid chemistry and isotope (87Sr/86Sr, δ13C) data from the novel ultramafic-hosted Irinovskoe (2790m depth) and Semenov-2 (2440m depth) vent fields (13°20’N and 13°30’N oceanic-core complexes, respectively [2]), sampled together with vent fluids from Azhadze II and Logatchev I [3] on the 12–15°N segment using isobaric gas-tight samplers in 2016.

Both Irinovskoe black smokers (356–359°C) and near-clear Semenov-2 fluids (311–313°C, mainly from fragile anhydrite chimneys) vent directly from corrugated surfaces, with compositions reflecting a single source fluid to vents at each site. Salinities are similar to seawater at Semenov-2 and Logatchev I, but higher at Irinovskoe and lower at Azhadze II, with an overall pH35°C range of 4.0 to 4.9. Endmember B concentrations in all fluids (200–295μmol/kg) are depleted relative to bottom seawater (413μmol/kg), implying substantial B uptake during olivine serpentinization. H2/CH4 ratios, however, vary dramatically between all 12–15°N vents (from 1.7 to 31), with H2 far less abundant at Irinovskoe and Semenov-2 than at Azhadze II or Logatchev I. Abundant (mmolar) dissolved CH4 at Semenov-2 and Logatchev I is ca. 5x that of Irinovskoe or Azhadze II. These data thus not only broaden known ultramafic-hosted vent fluid compositions, but highlight the potential for biogeochemical diversity within a single ~120 nm slow-spreading ridge segment.