

An experimental study of the stability of hydrosulfide species of Fe(II) at hydrothermal conditions

ART. MIGDISOV^{1*}, D. ZEIN²
AND A.E. WILLIAMS-JONES¹

¹Earth & Planet. Sci., McGill Univ., Montreal, H3A 2A7
Canada (*correspondence: artas65@gmail.com)

²Institute of Geochemistry and Petrology, ETH Zurich, CH-8902 Zurich, Switzerland

Iron is one of the most abundant elements in the Earth's crust, and is actively involved in the processes of hydrothermal alteration and ore mineralisation. Iron-bearing sulphides dominate most hydrothermal sulphide ore bodies and form in a wide variety of geological environments at conditions ranging from those of magmatic intrusions to those of sediments undergoing diagenesis. However, our knowledge of the speciation of this metal in sulphide-bearing fluids is surprisingly limited. Despite the participation of iron in processes involving reduced sulphur-bearing fluids, the behaviour of the hydrosulphide species of this metal is effectively unknown at elevated temperature. Partly because of this, the hydrothermal transport and deposition of iron is commonly modelled exclusively using chloride species. The goal of our study was therefore to determine stability constants for hydrosulfide complexes of Fe (II) experimentally at temperatures up to 350-400 °C, and to evaluate the contribution of these complexes to the mobilisation of iron in nature.

Our experiments were performed in light-weight titanium autoclaves and involved measurement of the solubility of pyrite (FeS₂) in acidic solutions (pH<3) saturated with respect to H₂S at partial pressures of this gas varying from 15 to 120 bars. The acidity of the solutions was controlled using HClO₄ for experiments at T≤250 °C, and HCl at higher temperature. After equilibrium was attained, the autoclaves were quenched, pyrite was removed, and samples of the quenched solutions were analysed for Fe and Cl. Precipitates that formed during quenching were dissolved by washing the autoclaves with HCl; the washing solutions were also analysed for Fe. All analyses were performed using NAA.

The data obtained in our study suggest that, at temperatures up to 300 °C, the dominant hydrosulphide species of iron are FeHS⁺ and Fe (HS)₂⁰. They also suggest that the concentration of these species is sufficient for them to play an important role in the transport and deposition of Fe (II) in H₂S-rich hydrothermal systems.

Isotope-geochemical features of enriched mantle source of rift tholeiites from Bouvet Triple Junction (South Atlantic)

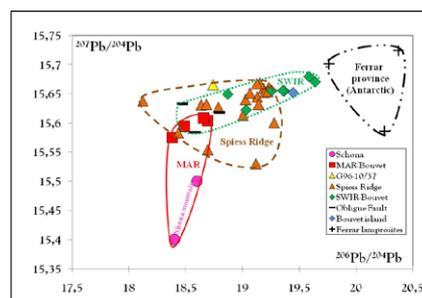
NATALIA A. MIGDISOVA^{1*},
NADEZHDA M. SUSHCHEVSKAYA¹
AND BORIS V. BELYATSKY²

¹Vernasky Institute of Geochemistry RAS, Moscow, Russian Federation (*correspondence: nat-mig@yandex.ru)

²VNIIOkeanologia, Antarctic Geology, St.Petersburg, Russian Federation (bbelytsky@hotmail.ru)

Bouvet triple junction (BTJ) is formed by three spreading ridges: Mid-Atlantic (MAR), American-Antarctic (AAR), South-West Indian (SWIR) and is marked by especially complicated construction and evolution. The isotopic analysis of glasses from the Spiess Ridge and Bouvet segment of SWIR revealed the relatively high ²⁰⁶Pb/²⁰⁴Pb (18.4 to 19.2) and low ¹⁴³Nd/¹⁴⁴Nd values (0.512603-0.513103) indicating the source enrichment compared to the depleted oceanic mantle [1]. Differences in ²⁰⁷Pb/²⁰⁴Pb vs ²⁰⁶Pb/²⁰⁴Pb contents in tholeiites from BTJ region and adjacent structures imply diverse magmatic sources. We assume that type of enrichment of BTJ mantle source is like HIMU and is close to those of lamprophyres from Antarctic Ferrar province formed during the Karroo - Ferrar plume influence about 180 m. y. ago [2]. Pyroxenite component in parental source was established by olivine composition [3] and generally constituted about 30-40 % of parental melts [3, 4].

One of the plausible explanations of so considerable amount of the ancient substance is the formation of the west end of SWIR over some crustal blocks which were separated during/ after Gondwana breakup. These microplates could comprise parts of a pre-existing retro-arc fold thrust belt [5].



- [1] Hauri & Hart (1994) *J. Geophys. Res.* **99**, 24301–24321.
[2] Riley *et al.* (2003) *Lithos* **66**, 63–76. [3] Sobolev *et al.* (2007) *Science* **316**, 412–417. **112**. [4] Migdisova *et al.* (2009) *Alpine Ophiolites & Modern Analogues, Continental rifting to oceanic lithosphere, insights from the Alpine ophiolites & modern oceans. Abstract volume*, **47**. [5] Martin (2009) *USGS OF-2007-1047, Extended Abstract* **112**.