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Investigating monomineralic and polyminerallc reactions during the oxidation of sulphide minerals in seawater: Implications for mining seafloor massive sulphide deposits

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1 **Investigating monomineralic and polymineralic reactions during the**
2 **oxidation of sulphide minerals in seawater: Implications for mining**
3 **seafloor massive sulphide deposits**

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9
10 **Abstract**

11 Seafloor massive sulphide (SMS) deposits are rich in metals, particularly Cu and Au, and are
12 attracting the attention of mining companies. However, there are various environmental
13 concerns associated with the potential extraction of these deposits, which includes the release
14 of heavy metals following the crushing and grinding of these deposits on the sea-floor as
15 sulphide mineral surfaces are exposed to, and oxidised by seawater. A series of
16 monomineralic and polymineralic sulphide mineral, batch reactor, abiotic oxidation
17 experiments were completed in an effort to assess the geochemical impacts of mining SMS
18 deposits in situ. Pyrite, chalcopyrite, sphalerite, and mixtures thereof, were reacted with
19 synthetic seawater under conditions similar to that of the seafloor at between 2-3 km depth (2
20 °C, pH 8.2), but under atmospheric pressure and equilibrated with air. Galvanic effects are
21 evident in the polymineralic experiments, predominantly the cathodic protection of pyrite by
22 the preferential oxidation of chalcopyrite and sphalerite. However, the reaction between
23 sphalerite and chalcopyrite remains unclear. Rates of reaction could not be quantitatively

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