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Hydrogen generation during serpentinisation in ophiolite complexes: A comparison of H2-rich gases from Oman, Philippines and Turkey.

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H2-rich gas seepages in ultrabasic to basic contexts both in marine and continental environment are by-products of serpentinisation. Hydrothermal systems at MOR expose ultrabasic rocks to thermodynamic conditions favouring oxidation of FeII bearing minerals and water reduction. In continental context such thermodynamic conditions do not exist although active serpentinisation occurs in all known ophiolitic complexes (Barnes et al., 1978; Bruni et al., 2002; Cipolli et al., 2004; Boschetti and Toscani, 2008; Marques et al., 2008). Hyperalkaline springs are reported in these contexts as evidence of this active serpentinisation (Barnes et al., 1967) and are often associated with seepages of reduced gases (Neal and Stanger, 1983; Sano et al., 1993). Dry gas seepages are also observed (Abrajano et al., 1988, 1990; Hosgörmez, 2007; Etiope et al., 2011)

Such H2-rich gases from ophiolite complexes were sampled in the Sultanate of Oman, the Philippines and Turkey and were analysed for chemical composition, noble gases contents, stable isotopes of carbon, hydrogen and nitrogen.

The conditions for present-day serpentinisation in ophiolites were recognised as low temperature processes in Oman with high rock/water ratios (Neal and Stanger, 1985), while the origin of gases is not as univocal for Philippines and Turkey gas seepages. Although, H2 generation is directly linked with FeII oxidation, different reactions can occur during peridotite hydration (McCollom and Bach, 2009; Marcaillou et al., 2011) and serpentine weathering. Produced H2 can react with carbonate species to produce methane via processes that could be biological or abiotic, while carbon availability depends on water recharge chemistry.

In the present study, the geochemical properties of gases sampled from three different ophiolite complexes are compared and provide evidence that weathering reactions producing H2 depend on structural, geological, geomorphologic and hydrological local features.

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