The role of surface charge and exchange cation speciation on the structure of interfacial water in nontronite suspensions

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Attenuated total reflection infrared spectroscopy (ATR-FTIR) was used to investigate the structure of water at the surface of suspensions of the nontronites, NAu-1 and NAu-2. Raw ATR spectra were converted to absorption index (k) spectra via the Kramers-Kronig transform to allow direct comparison of samples with different indices of refraction. Difference spectra produced from these k spectra allowed subtle shifts in the O-H stretching region to be discerned, thereby providing information about differences in the degree of hydrogen bonding. Suspensions of both NAu-1 and NAu-2 exchanged with either Na+ or K+ exhibit increased hydrogen-bonding at the mineral/water interface as compared to bulk water. NAu-1, which has greater total and tetrahedral charge than NAu-2, shows no change in water structure upon reduction of structural Fe or the addition of a small excess of electrolyte. These observations suggest that the ordering of interfacial water in NAu-1 suspensions is dominated by the highly charged mineral surface. Reduction of structural Fe in NAu-2 results in changes to the interfacial water structure that are dependent on the exchange cation species. In this case, reduction produces a significant increase in tetrahedral charge, which alters the interactions of the exchange cations with the surface.

A Tertiary record of Australian plate motion from ages of diamondiferous alkalic intrusions

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Multiple geo/thermochronometry datasets (zircon (U-Th)/He[1], phlogopite $^{40}Ar/^{39}Ar$ and wadeite $^{40}Ar/^{39}Ar$) have been acquired from four Western Australian kimberlite and lamproite localities distributed over 850 km. The linear orientation of the eruption centres (~015°), southwardly younging emplacement ages, and apparent co-linearity with modern geodetic measurements has implications for Australian plate geodynamics (Fig. 1).

The Fohn diatreme field consists of ~30 lamproite pipes discovered during oil exploration in the Timor Sea[2]. Phlogopite recovered from lamproite cuttings in an offshore exploration well (Fohn-1) returned a robust plateau $^{40}Ar/^{39}Ar$ age of 29.4 ± 0.7 Ma (P=0.99). A diamond pipe from the North Kimberley kimberlite field (Seppelt) yielded four zircon grains with thermally reset (U-Th)/He ages averaging 25 Ma. Diamondiferous pipes at Ellendale contain xenocrystic zircon grains with (U-Th)/He ages of 20.6 ± 2.8 Ma that were thermally reset by lamproitic intrusions. Other researchers[3] report K-Ar ages for the Noonkanbah lamproite field of ~19 Ma, whereas $^{40}Ar/^{39}Ar$ dating of wadeite from the Walgidee Hills lamproite yielded plateau ages of 17.46 ± 0.17 Ma (P=0.44).

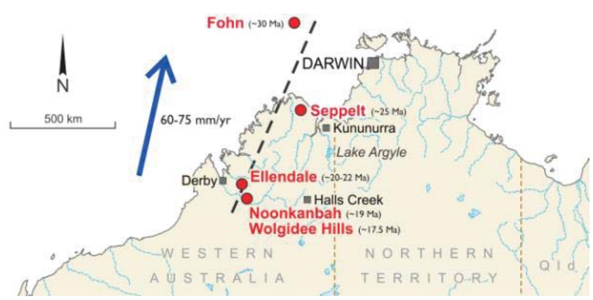

Figure 1: *Age-distance relationships of WA lamproites (red) and Australian plate motion as determined by GPS (blue arrow).*

Geodetic measurements indicate that the Australian plate is currently moving NNE at a rate of 60-75 mm/year relative to the Eurasian plate, whereas long period geospeedometry estimates range from 50-78 mm/year[4]. The age-distance relationship between the Fohn and Wolgidee Hills sites in this study are consistent with a plate motion of 70 mm/yr during the Tertiary.

[1] McInnes et al (2009) *Lithos* **112S**, 592-599. [2] Gorter and Glikson (2002) *AJES* **49**, 847-868. [3] Jaques et al (1986) *GSWA Bull.* **132,** pp. 267. [4] Wellman and McDougall (1974) *Tectonophys.* **23** 49–65.