Understanding the global marine δ^{30}Si distribution

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The silicon isotopic composition of opal sediments can be used as a proxy for past Si utilization, and hence paleo-productivity given constant upwelling rates. Interpretation of this Si utilization proxy is limited by our understanding of the present marine Si isotope distribution (which is being addressed within the GEOTRACES program), and the effect of hydrographic changes on this distribution. Observations show significant Si isotopic variations (expressed as δ^{30}Si) of silicic acid between deep-water masses (>0.3‰). However, no variations (<0.1‰) should be expected following a GCM model of the marine Si cycle [1], or by comparison to the observed δ^{15}N distribution [2].

Although the quality and reproducibility of the δ^{30}Si values have been questioned, intercalibration exercises have confirmed the precision and accuracy between laboratories and measurement techniques [3]. We thus have to question current estimates of Si fluxes and the modeling of the Si cycle.

The apparent conflict between observations and model results have been investigated using simplifed multi-box models of the global oceans (e.g. Pandora). These simple box models for the Si cycle can predict the observed 0.3‰ difference between Atlantic and Pacific deepwater δ^{30}Si values, using published estimates of regional opal export fluxes. Thus, the δ^{30}Si distribution is in agreement with existing estimates of the marine Si fluxes. Futhermore, the sensitivity of the δ^{30}Si distribution to changes in the Si cycles has be explored to estimate likely changes that may occur over glacial-interglacial cycles.

The δ^{30}Si difference between deepwaters results from (1) a high δ^{30}Si of dissolved Si subducted in the North Atlantic and (2) the dissolution of opal with low δ^{30}Si values in the deep-waters around the Southern Ocean which feeds into the Pacific. Contrasting deep-water δ^{30}Si values are not strongly affected by increasing meridional overturning circulation, unlike δ^{13}C. The marine δ^{30}Si distribution is distinct from δ^{13}C and δ^{15}N because Si behaves differently between the high latitudes of the North and Southern Hemispheres.

[1] Wischmeyer *et al*. (2003) GBC **17**(3), 1083. [2] Sigman *et al*. (2000) JGR **105**(C8), 19599-19614. [3] Reynolds *et al*. (2007) JAAS **22**(5), 561-568.

The relationship between quartz diorite and granite: An example from the Uromieh-dokhtar magmatic belt

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Uromieh-dokhtar magmatic belt is one of the major granitic provinces in the Iran and has long attracted the interest of Iranian geologists. It lies along the tectonic boundary between the Sanandaj-Sirjan (metamorphic belt) and the micro-continental of Central Iran. The NW Saveh intrusions are a part of this belt and consist of three main intrusive rock types including hornblende- and pyroxene-bearing quartz diorite, hornblende- and pyroxene-bearing granodiorite and hornblende granite. They are vary in silica contents between 46 and 72%, and are metaluminous. Excepting Na_2O the major element oxides vs. SiO_2 diagrams display linear trends. SiO_2 vs K_2O [1] and SiO_2 vs Na_2O+K_2O [2] diagrams suggest that the bulk of the samples plot in the calc-alkaline field. The ASI (Aluminium Saturation Index, molar Al_2O_3/ Na_2O+K_2O+CaO) for all samples is <1, and molar Al_2O_3/Na_2O+K_2O is higher than one, indicating that they are metaluminous I-type granitoids. The low normative corundum values (<1.6%) are consistent with I-type granitoids. On Harker variation diagrams, Sr and Ga show linear descending trends versus SiO_2, whereas Zr, La and Ce increase with the SiO_2 increasment. However, Sr and Ba show a good correlation in the granites whereas an opposite trend occurs in the quartz diorite. In most of the variation diagrams, the granite lie along or close to the trends defined by quartz diorite rocks and commensurate with fractional crystallization. The NW Saveh intrusions plot in the volcanic arc granite field in both the Rb vs Y+Nb and Nb vs Y discrimination diagrams of Pearce *et al.,* [4]. They behave homogeneously on the chondrite normalized REE plots, with $La_N/Yb_N = 5$, fairly flat HREE from Dy to Lu, and negative Eu anomalies. Base on major and trace element signatures, they are typical of calc-alkaline series developed at active continental margins by partial melting from metasomatised mantle wedge.

[1] Peccerillo & Taylor (1976) *CMP* **58,** 63–81. [2] Barker & Arth (1976) *Geology* **4,** 596–600. [3] Pearce *et al.* (1984) *Journal of Petrology* **25,** 956–983.