Holocene temperature evolution of the subpolar North Atlantic recorded in the Mg/Ca ratios of surface and thermocline dwelling planktonic foraminifers

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A high resolution record of Holocene Mg/Ca ratios measured on the planktonic foraminifers *Globigerina bulloides* and *Globorotalia inflata* have been produced for IMAGES core MD99-2251 (57° 26′N, 27° 54′W; 2620 m water depth) from the subpolar North Atlantic. Specimens used for measurement by ICP-AES were picked from the 300-355 μm size range, with 25-35 specimens of each species picked per sample. The records extend from the Younger Dryas-Preboreal transition through the Holocene at ~70 year resolution, with a more detailed section at ~20 year resolution through the interval encompassing the final decay of the ice sheet that culminated around 8000 years ago. The modern surface oceanography of the study area is dominated by the convection of the warm saline waters of the North Atlantic Current (NAC), with the shell chemistry of *G. bulloides* and *G. inflata* reflecting late spring to summer conditions within this watermass at the near-surface and the thermocline, respectively. Mg/Ca ratio data reveal significant fluctuations through the Holocene, with values ranging from 1.6 to 2.6 mmol/mol for *G. bulloides* and 1.0 to 1.7 mmol/mol for *G. inflata*. Temperature estimates, calculated using species-specific Mg/Ca-temperature calibrations, indicate a range of 7-13°C with both species exhibiting variability of 3-4°C. The records of surface and thermocline temperature show coherent patterns through the Holocene, with a distinct long-term warming trend evident over the last 5000 years. Variations at higher frequencies also appear to be mirrored in both temperature records indicating a coupling between near surface and thermocline environments within the NAC. However, at times the significance of these brief climate fluctuations is difficult to evaluate as the scale of the temperature change is only slightly greater than the uncertainty associated with intra-sample reproducibility.

Space-time-composition variations in continental magmatism during mid-Tertiary low angle subduction, western U. S

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The western U.S. has long been known to have experienced a mid-Tertiary “ignimbrite flare-up”, during which largely intermediate to silicic magmatism occurred up to 1,000km inboard from the contemporaneous convergent plate margin. This intraplate magmatism was likely related to low angle subduction of oceanic lithosphere beneath the North American continent, but the exact source(s) and trigger mechanism(s) for the magmatism remain enigmatic. Construction of the North American Volcanic and Intrusive Igneous Rock database (NAVDAT) now affords the possibility of investigating in detail space-time-composition patterns in this magmatism and of using these patterns to refine models for the origin of this magmatic event. For example, maximum Sr/Nb ratios for volcanic rocks comprising major mid-Tertiary volcanic fields increase from Nevada to the Rocky Mountain region, suggesting an east to west increasing slab component in their mafic parental magmas (and/ or an increasing interaction with preexisting crust). The slab component is absent in “back arc” alkalic volcanic rocks (e.g. the Trans-Pecos of west Texas). Sr/Nb also decreases from W-E in contemporaneous arc magmatism of the ancestral Cascades, suggesting that high apparent slab component in even the most mafic volcanic rocks at the 20-40Ma Rocky Mountain volcanic centers must have been inherited from mantle metasomatized as a result of “flat-slab” subduction. This observation reveals that space-time-composition data can be used to distinguish mid-Tertiary volcanism associated with “normal” continental margin arc processes from that likely related to reconfiguration of older oceanic lithosphere that underplated the continental lithosphere during low angle subduction.