



## Natural iron fertilization and the HNLC phenomenon

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Away from the poles, all oceans are either permanently or seasonally low in macronutrients except for three exceptions: the high-nutrient, low-chlorophyll (HNLC) regions of the subarctic North Pacific, the eastern Equatorial Pacific and the Southern Ocean. The HNLC condition is thought to be caused by lack of iron. If, because of a sedimentary source, “iron is not likely to be biolimiting above a continental shelf” (Bucciarelli et al. 2001 *Mar. Chem.*, **73**:21-) then shallow waters should not be HNLC.

We investigated whether HNLC conditions occur over shelves around the subarctic North Pacific. We compared high-resolution datasets of satellite chlorophyll and bathymetry to see shallow seafloor (< 200m) causes alleviation of the LC part of HNLC. Despite advection by eddies and currents we found a statistically robust correlation of higher chlorophyll concentrations over shelves. Because satellite chlorophyll estimates are less robust in Case 2 waters we also analysed in-situ data and found similar shallow vs. deep differences. From in-situ nitrate datasets we found that the HN part of HNLC is removed over shallow topography such as over the shelf south of Alaska and over the wide shelf of the eastern Bering Sea.

We conclude that spring blooms and macronutrient depletion over shallow topography are consistent with the findings from recent artificial iron enrichments: that iron scarcity is the predominant cause of the HNLC phenomenon.