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Water mass movement in the North Atlantic, IODP Exp 324, during the early Eocene 'greenhouse'.

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The early Eocene (56-45Ma) witnessed the last great interval of prolonged global warmth with deep oceans showing temperatures of at least 12°C above modern day values. It is currently unclear where, and indeed how, deep waters formed during such globally high temperatures, without a large temperature gradient between poles. Here, we investigate changes in ocean circulation and water mass movement throughout the early Eocene using Neodymium isotopes derived from fish teeth from IODP Sites 1403 (abyssal paleodepth $\approx$ 4.5km) and 1409 (paleodepth$\approx$ 2km). These newly drilled sites (2012) are located in the North West Atlantic on the Newfoundland ridge, directly in the pathway of the modern day Deep Western Boundary Current. Their location offers the opportunity to examine whether there was in fact, a site of Northern Hemispheric deep water production in the young Atlantic during the early Eocene.

Neodymium isotopes act as a geochemical tracer of deep water masses due to the weathering of continental materials with different age dependent isotopic signatures, entering the oceanic realm in the source area of sinking waters. Our initial results from Newfoundland, suggest that the εNd value (where εNd = 143/144Nd normalised to CHUR x 10,000) of deep waters flowing across both sites show a narrow range of values of -10 to -11 from 50 Ma to 43Ma, but prior to 50Ma, both sites have typical εNd values of -9. Such a stepped change suggests changes in either 1) the source of deep waters flowing across the sites, or 2) a change in weathering inputs into the region. This study aims to explore whether there is in fact, a site of northern hemisphere deep water formation at this time, and explore the possible scenarios where a change in water mass composition around 50Ma might be observed.