Goldschmidt 2022 Abstract
https://doi.org/10.46427/gold2022.9610

Marine Ice: A sleeping iron giant in the Southern Ocean?

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The Polar Southern Ocean (PSO) provides an excess amount of macro-nutrients but productivity is largely limited by the availability of essential micro-nutrients, namely iron, manganese, zinc and others. Seasonal patches of increased productivity off major ice shelfs around Antarctica suggest that local sources of these deficient micro-nutrients must be present. With this session contribution we present a new study on marine ice from the Filchner-Ronne Ice Shelf (FRIS) as a potential source of iron and other limiting micro-nutrients for the Atlantic sector of the PSO. Marine ice is formed via partial melting of meteoric shelf ice near the grounding line of large ice shelves (e.g. FRIS). During this process small refrozen ice platelets accumulate in a layer of over 100 m thickness underneath the ice shelf to form marine ice containing high amounts of particulate material. In a project funded by the German Research Foundation (DFG) within the priority program SPP1158, we analyse 2 marine ice cores (B13: 62m, B15: 167m of marine ice) recovered in the 1990's from the FRIS on their geochemical compositions. The coring location of B13 was about 40 km away from the shelf ice edge and B15 was drilled another 136 km further inland along the reconstructed flow line of B13. Due to shelf ice migration over the last 30 years, their locations have shifted about 30 km towards the shelf ice edge. First results show dissolved Fe (dFe) and Mn (dMn) concentrations ranging between 30 and 300 nMol and particulate Fe (pFe) of 20 to 120 µMol (0.2 to 1.4 µMol for pMn). These concentrations are orders of magnitude higher than the ones currently found in the PSO for those elements. Basal melting and ice-berg calving of marine ice with the accompanied release of these essential trace metals could therefore fuel local productivity in regions with large extent of shelf ice. With our study we aim to evaluate marine ice as potentially overlooked source for limiting micro-nutrients that could explain high productivity areas within an otherwise relatively low productive PSO.