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Polar ocean gateways: the keys to understanding long-term global change

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The world's oceans are a major component of the Earth System, and changes in the complex global current system, which transports heat, salt and nutrients between oceans, are likely to cause global environmental changes. Water mass exchanges between the Arctic Ocean and the northern Atlantic and Pacific, and between the southern Pacific, Indian and Atlantic Oceans through the Antarctic Circumpolar Current, play a crucial role in global circulation. Water mass exchange between oceans is controlled by the tectonic opening and closing of strategic oceanic passageways (gateways), and by changes in sea-floor depth in these gateways. The inception of new oceanic currents and changes in circulation through time are widely thought to have been responsible for major global climatic and environmental changes on Earth. Establishing the detailed tectonic, geodynamic, sedimentary and palaeotopographic histories of strategic oceanic gateways will provide the essential framework for modelling studies that will help relate these events to palaeo-climate observations collected across the globe. We propose an IPY project, "POLARGATES", to promote multidisciplinary research that will improve knowledge of the tectonic-magmatic, geodynamic, sedimentary and biostratigraphic histories of, as well as past and recent oceanographic conditions in, the polar ocean gateways. POLARGATES studies will involve state-of-the-art geophysical techniques, sediment coring, ocean drilling, use of palaeobiological and geochemical proxies, oceanographic observations, and onshore investigations of areas flanking gateways.