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PRELIMINARY PERMAFROST AND GROUND ICE MAPS OF ANTARCTICA

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Only 0.33% of the 14 million km^2 Antarctic region (>60ºS) is ice-free. Ice-free areas, which include exposed bedrock as well as unconsolidated materials, can be divided into eight subregions. The Transantarctic Mountains (TAM), which bisect the continent, contain about 45% (20,000 km^2) of the ice-free area. The Antarctic Peninsula and its offshore islands constitute the second largest ice-free area at 13,600 km^2 (35% of area). The other ice-free regions, including the Vestfold Hills, Queen Maud Land, the Pensacola Mountains, the Ellsworth Mountains, Marie Byrd Land, Enderby Land, and Wilkes Land, contain the remaining 20% of the ice-free area. The McMurdo Dry Valleys (MDV, 4,800 km^2) in the central TAM constitute the single largest ice-free area in Antarctica. In this study we provide preliminary permafrost maps for each of the key ice-free subregions, the MDV, and individual valleys within the MDV, including the Victoria Valley system, Wright Valley, and Taylor Valley. Based on our analysis, continuous permafrost occurs throughout the continent from the interior to about 67ºS along the Antarctic Peninsula. Discontinuous permafrost occurs along the Antarctic Peninsula (>67ºS) but is continuous at elevations above 50 m. Sporadic permafrost occurs in the Antarctic and subantarctic islands (ca. 60-62ºS), primarily at the higher elevations. Ice-cemented permafrost is dominant in all subregions, but dry-frozen permafrost occurs in the Sør Rondane Mountains, the Prince Charles Mountains, and the TAM. In the TAM about 35% of total area of permafrost is dry-frozen. Permafrost form is related to climatic zone, age of sediments, and local site factors. Ground ice is present in ice-cored alpine moraines and coastal tills of Holocene age, hummocky drifts of late Quaternary age (ca. <115 ka) and pyroclastic materials of unknown age along the Antarctic Peninsula. Ice-cemented permafrost is present not only in coastal areas and in sediments of late Quaternary age, but also occurs in soils of pre-Quaternary-age along the Polar Plateau. Dry-frozen permafrost occurs in interiors of larger ice-free valleys on sediments of pre-late Quaternary age. Dry-frozen permafrost, which may be unique to Antarctica, appears to form from sublimation of moisture in ice-cemented permafrost over time.