# Shallow Sub-Permafrost Groundwater Systems In A Buried Fjord: Taylor Valley, Antarctica

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The McMurdo Dry Valleys (MDV), Antarctica, represent a unique geologic setting where permanent lakes, ephemeral streams, and subglacial waters influence surface hydrology in a cold polar desert. Past research suggested that the MDV are underlain by several hundreds of meters of permafrost. Here, we present data collected from an Airborne EM (AEM) resistivity sensor flown over the MDV during the 2011-12 austral summer. A focus of our survey was over the Taylor Glacier where saline, iron-rich subglacial fluid releases at the glacier snout at a feature known as Blood Falls, and over Taylor Valley, where a series of isolated lakes lie between Taylor Glacier and the Ross Sea. Our data show that in Taylor Valley there are extensive areas of low resistivity, interpreted as hypersaline brines, beneath a relatively thin layer of high resistivity material, interpreted as dry- or ice-cemented permafrost. These hypersaline brines remain liquid at temperatures well below 0°C due to their salinity. They appear to be contained within the sedimentary fill deposited in Taylor Valley when it was a fjord connected to the Ross Sea. This brine system continues up valley and has a subglacial extension beneath Taylor Glacier, where it may provide the source that feeds Blood Falls. By categorizing the resistivity measurements according to surficial land cover, we are able to distinguish between ice, permafrost, lake water, and seawater based on characteristic resistivity distributions. Furthermore, this technique shows that areas of surface permafrost become increasingly conductive (brine-filled) with depth, whereas the large lakes exhibit taliks that extend through the entire thickness of the permafrost. The subsurface brines represent a large, unstudied and potentially connected hydrogeologic system, in which subsurface flows may help transfer water and nutrients between lakes in the MDV and into the Ross Sea. The widespread presence of brines beneath ice and permafrost in the MDV raises the possibility that similar systems exist across the coast of Antarctica and therefore that submarine groundwater discharge is a more significant factor than previously thought. Such a system is a potential habitat for extremophile life, similar to that already detected in the Blood Falls outflow, and may serve as a terrestrial analogue to potential extraterrestrial habits, where liquid surface waters are not expected to exist.

**Theme:**

- Ice-ocean interaction *(Surfin' USA)*
    - **everywhere else (*Promised Land)***