SUB-ICE MARINE AND PLANETARY ECOSYSTEMS: FIRST RESULTS FROM BELOW THE MCMURDO ICE SHELF. B. E. Schmidt[1], S. Kim[2], C. C. Walker[1], M. E. West[1], M. M. Meister[1], A. Spears[1], J. J. Buffo[1], J. S. Greenbaum[3], M. Skidmore[4], L. Barker[2], J. Burnett[5], M. Hynes[2], G. Echeverry[3], K. M. Soderulund[3], E. VanTil[1], D. D. Blankenship[3], N. Bramall[6] P. Doran[7], A. Johnson[8], F. Rack[5], V. Siegel[9], W. C. Stone[9], D. A. Young[3]. [1]Georgia Tech (britneys@eas.gatech.edu), [2]Moss Landing Marine Lab, [3]UTIG, [4]Montana State, [5]UNL, [6]Leiden Measurement Tech., [7]LSU, [8]U. Ill. Chicago, [9]Stone Aerospace.

Introduction: While on the surface, Europa and the Earth may seem very different worlds, just below their respective icy crusts, the two likely share similar oceanic conditions, including temperatures, pressures (within a factor of a few) and potentially even salinity. Thus the interface between Earth's thick ice shelves and ocean is an important and little-explored analog for the physicochemical, and possibly microbial, characteristics of icy worlds. Here, processes of melt, freeze, and accretion are controlled by gradients in ice thickness, currents, and ocean temperature and salinity. The details of exchange between the ice and the ocean are not well characterized, even on Earth, due to their remote nature and challenges in exploring beneath the ice. In particular, the impact this exchange may have on the potential for the ice at the interface to host or influence microbial communities is poorly understood. For Europa, any material formed at the interface may be subject to transport upward through convection or diapirism, potentially delivering ocean-derived materials to the shallow subsurface, participating in an ice "conveyor belt" that will affect the habitability of Europa's ice and ocean alike. Thus in planetary environments, ice-ocean interactions may not only provide a habitable niche at ice-ocean interfaces, but also influence habitability within ice shells by carrying nutrients up and down. Moreover, ice accretion may entrain evidence of oceanic conditions that could influence remote measurements.

SIMPLE in Antarctica:, NASA's SIMPLE project (Sub-Ice Marine and PLanetary-analog Ecosystems), has been tasked with characterizing ice and ocean processes below and within the McMurdo Ice Shelf (MIS), in the 2012, 2014 and 2015 austral summer Antarctic field seasons. The MIS is a small portion of the Ross Ice Shelf easily accessible from the U.S. McMurdo Station. Using sub-ice vehicles, ice penetrating radar, and other measurements of this unexplored region, the SIMPLE team is building a comprehensive picture of processes at the ice-ocean interface and within the brine-infiltrated ice shelf in order to advance hypotheses for Europa. In addition, the technologies supported by the project are advancing NASA's capabilities to detect processes and properties within ice by ice penetrating radar, and with *in situ* measurements, that will support Europa Clipper and pave the way for future landers, and hopefully one day the subsurface.

First Results: We have collected imaging data of the ice and its inhabitants, as well as conductivity and temperature profiles of the water column at discrete locations beneath the MIS.In 2012, the team explored at a single location 5km back from the front of the ice shelf using the small ROV SCINI (MLML, S. Kim). Here, we observed ablation of the ice and a heterogeneous upper ~100m of the water column, consistent with melting by fast currents. Both imaging data and the CTD profiles are consistent with this conclusion.

In 2014, SIMPLE utilized SCINI and a new AUV/ROV vehicle, *Icefin* (Georgia Tech, B. Schmidt), to characterize 5 sites beneath the MIS. These locations ranged between 10 and 20 km from the ice shelf front. Here, we observed different ice conditions from those in 2012. Uniformly, large amounts of platelet ice formation was observed, regardless of ice shelf thickness. The layer of platelets was between 1 and 3 meters thick depending on the site, and ranged between relatively uniform in character to regions with large platelet spears and columns. At the site near Black Island, we observed the possible formation of a few-meter thick compressed layer of platelet ice, physically separated from the bottom of the shelf by a thin water lens,, at the base of which was presumably newer platelet ice. We observed a homogeneous water column in terms of temperature and conductivity, from the ice-ocean interface to the seafloor, consistent with the formation of platelet ice. We also observed a complex community of macro fauna at the seafloor under this permanent ice cover.

Implications: McMurdo Ice Shelf is an interesting test bed for both the processes of ice-ocean exchange and for icy satellite remote and *in situ* sensing. The 2015 season with ARTEMIS (Stone Aerospace, W. Stone) promises to be exciting by extending the exploration range and allowing us to observe gradients in sub-ice processes, rather than at discrete sampling locations. In this presentation, I will describe the project, and results to date, including imaging and preliminary mapping of the conditions within and below the ice shelf from field work thus far.

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