Insights into the Sea-Level History of the South Shetland Islands from Ground Penetrating Radar on Livingston Island, Antarctica

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Abstract

The Antarctic Peninsula (AP) contains enough meltwater equivalent ice to raise global sea levels 2.4m (Pritchard and Vaughan, 2007). To better understand how this region will behave in the future relies on reconstructing past trends in ice mass. Nearly 10 km of ground-penetrating radar (GPR) imaging of beach architecture and 60 optically stimulated luminescent age dating samples were collected on the South Beaches of Livingston Island, of the South Shetland Islands in an attempt to update the current relative sea-level curve for the region. Utilizing the geometry of the beach subsurface in addition to collecting ages from areas of the beach that are undated will help improve the resolution of this sea-level curve. In GPR profiles, evidence was found of seaward-dipping prograding geometries as well as landward-dipping overwash geometries. Preliminary results suggest there are perturbations in sea level not captured in the current indices that is observed in our subsurface imaging. Dates are currently in clusters on top of beach ridges and scarce in intermediary strand plains. Our increase in sampling density of beach formation ages attempts to bridge this gap in indices and create a more representative sea-level curve for the region by constraining uplift rates. The study area is situated over an active arc and the resulting underlying upper mantle viscosity decrease causes the South Shetlands to respond more sensitively to ice mass changes. These glacial isostatic adjustment sensitivities result in higher order ice mass fluctuations being captured, by proxy, in beach formation. We found that there are fluctuations in relative sea-level that are not reflected in these current sea-level curves. We interpret that beach

ridges in our study area are morphologically controlled and situated upon wave cut scarps in bedrock formed by sea-level rise. The resulting sea-level curve from this study will aid in constraining the underlying mantle rheology of the region which will improve accuracy for input into the ice models.