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Holocene sea-level changes in the Falkland Islands

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In many locations in the southern hemisphere, relative sea level (RSL) reached its maximum position during the middle Holocene. This highstand is used by models of glacial isostatic adjustment (GIA) to constrain the melt histories of the large ice sheets, particularly Antarctica. In this paper we present the first Holocene sea-level record from the Falkland Islands (Islas Malvinas), an archipelago located on the Patagonian continental shelf about 500 km east of mainland South America at a latitude of ca. 52 degrees. Unlike coastal locations in southernmost South America, Holocene sea-level data from the Falklands are not influenced by tectonics, local ice loading effects and large tidal ranges such that GIA and ice-ocean mass flux are the dominant drivers of RSL change.

Our study site is a salt marsh located in Swan Inlet in East Falkland, around 50 km southwest of Stanley. This is the largest and best developed salt marsh in the Falkland Islands. Cores were collected in 2005 and 2013. Lithostratigraphic analyses were complemented by analyses of foraminifera, testate amoebae and diatoms to infer palaeoenvironments. The bedrock, a Permian black shale, is overlain by grey-brown organic salt-marsh clay, up to 90 cm thick, which, in a landward direction, is replaced by freshwater organic sediments. Overlying these units are medium-coarse sands with occasional pebbles, up to 115 cm thick, containing tidal flat foraminifera. The sandy unit is erosively overlain by a grey-brown organic salt-marsh peat which extends up to the present surface. Further away from the sea this unit is predominantly of freshwater origin.

Based on 13 radiocarbon dates we infer that prior to $\sim$9.5 ka sea level was several metres below present. Under rising sea levels a salt marsh developed which was suddenly drowned around 8.4 ka, synchronous with a sea-level jump known from northern hemisphere locations. Following the drowning, RSL rose to its maximum position around 7 ka, less than 0.5 m above present sea level. RSL then fell slowly during the middle and late Holocene, eroding the elevated tidal flat deposits in places, and allowing development of thin salt marsh deposits and encroachment of freshwater marsh. Our new sea-level index points are roughly in agreement with GIA model predictions but place tight constraints on the timing of early Holocene RSL rise and the height and timing of the maximum Holocene RSL position.