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Identifying the provenance of sediments in melting season in Artic Aldegonda Glacier (Svalbard)

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As glaciers retreat proglacial zones are expanding thus creating new exposed surfaces of highly reactive rocks. New sources of sediments appear and there is a need for a better understanding of how they will affect sediment flux and storage in the rapidly changing glacierized areas of the maritime Artic region. Aldegonda Glacier, located in Western Spitsbergen Island, is 3km long by 2km width with an elevation from 160 to 450 m a.s.l. In 1911 the glacier tongue reached the seashore but since then Aldegonda Glacier has retreated about 2km likely due to the temperature increase that has been recorded at Barentsburg weather station (5km NE of the glacier) from 1911. The glaciological investigations carried out in the area since 1965 indicate a negative mass balance and both frontal and lateral glacier shrinks along with an average 64 m lowered surface from 1936 to 2004.

During a two weeks expedition in the frame of IAEA INT5153 project at the end of July 2015, a field survey of the Aldegonda Glacier area was undertaken to identify the main glacial deposits and their connectivity with the drainage network. The exposed materials are bottom moraine that covers Mesozoic outcrops. The moraine complex is drained by a system of 4 main streams originating at the glacier that dissect the moraine plain and merge into Aldegonda River that forms a delta at Grønfjord Bay. The snow and ice melting during the summer season is at its peak and the Aldegonda River is charged of sediments creating a visible brown plume at the bay. The use of the Aldegonda River as a water supply for the settlement of Barentsburg ceased in 1930 due to the high sediment load and rapid glacier retreat.

Sampling sites were selected across the moraine complex to collect 17 composite source samples and another 7 of surface sediments on the glacier. Besides a total of 10 sediment mixtures in moraine lakes and in the drainage system corresponding to higher floods and 3 samples of suspended sediments close to the glacier tongue and at the end of the Aldegonda River in the delta were collected for identifying the main provenance of sediments. General analyses included grain size, carbonates, pH, electrical conductivity, total carbon and nitrogen. For using the fingerprinting technique we analysed 7 radioisotopes (3 FRNs and 4 ERNs), stable isotopes (^{13}C and ^{15}N), magnetic susceptibility and a total of 28 stable elements. The preliminary results after applying FingerPro unmixing model identify the moraines as the main source of sediments, preferably the more recent moraines. We found different sediment contributions depending on the location along the streams and the Aldegonda River. A greater proportion from the surface sediments on glacier was found in areas close to the glacier tongue and at the Aldegonda River outflow in the bay. However, along the delta the sediments representing higher floods had much larger proportion of moraine sources suggesting the key role of runoff eroding the moraine complex and supplying sediments during the peak of the melting season.