Beach measurements at Alviðruhamrar, South-Iceland.

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Measurements at Alviðruhamrar and Þykkvabæjarklaustursfjara beach

Sections of Þykkvabæjarklaustursfjara beach were measured on the 15th of June 2024. A ground control point from the National Land Survey of Iceland, LM 2020 ALHV, was used to set up a point (Alvidrahamrarfp) for a GPS base near the measuring site to get precise measurements. The coordinates and elevation for both points are in table 1, coordinates in ISN93 and height in the height system of Vik (-1,03m compared to ISN2004).

Table 1 shows the coordinates for LM2020 ground control point and the control point Alvidrahamrarfp, with their heights in the height system of Vík (m).

LM 2020 ALHV	327943.1777	534539.8827	11,45
Alvidrahamrarfp	325446.6134	528147.0997	7,36

Five profiles were measured on Þykkvabæjarklaustursfjara beach, where the distance between the lava field edge at Alviðruhamrar and the ocean is at its shortest (fig 1 and 2). The edge of the lava field in the vicinity of the profiles was also measured along with the eastern part of the field, and the berm crest within the area of the profiles.

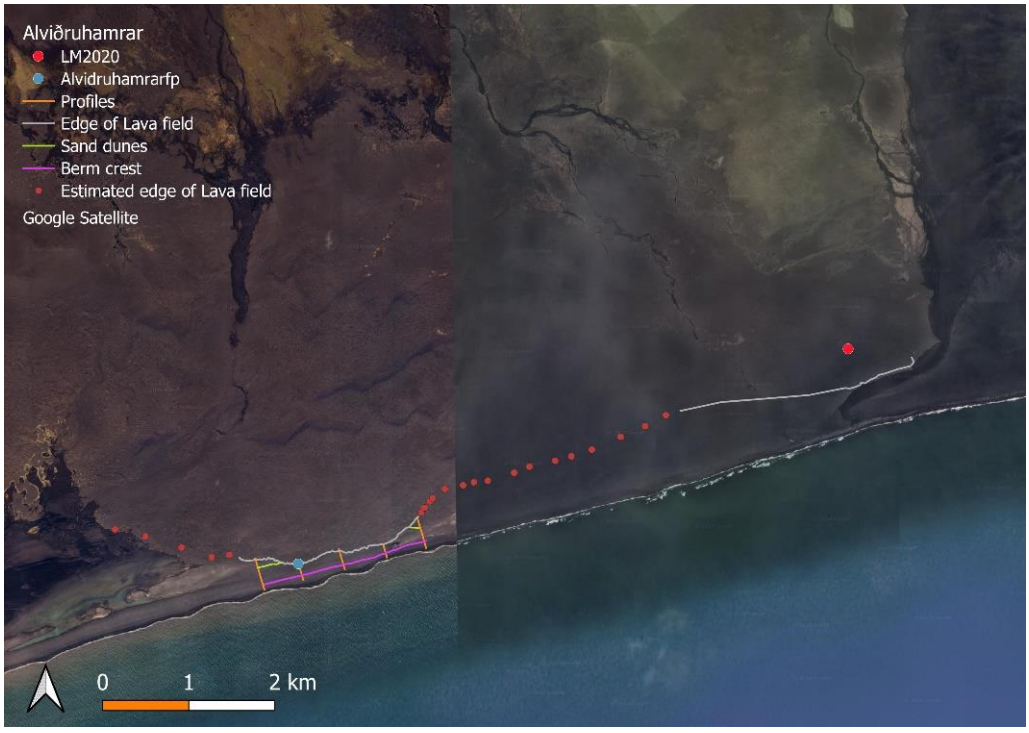


Fig 1 shows the area of Þykkvabæjarklaustursfjara beach, its vicinity, and the two control points used for the measurements. It also shows the measured and the estimated edge of the lave field, along with the location of the profiles, sand dunes and the berm crest.



Fig 2 shows the beach in front of Alviðruhamrar, along with the measured profile lines, the edge of the lava field, the berm crest and where sand dunes are in front of the edge of the lava field.

Lava field edge and sand dunes

The lava edge is eroded basalt, often with columnar jointing near the top but is more dense underneath. The edge of the lava field is, in most places, several meters higher than the beach in front of it but in other areas (estimated edge of lava field on fig 1) the edge is not visible due to being covered with sand and/or partially vegetated sand dunes. The edge that was clearly visible was measured and the estimated location of the edge was plotted out by using aerial photographs to fill in the missing measurement data. Older aerial photographs give a good indication of where the edge is in most cases, however, on the western side of the measuring area the edge is fully submerged in sand and debris and is almost impossible to locate precisely. Within the measured area, the edge is the beach ridge of the beach, with debris and larger rocks having been washed up on it during storms.

Sand dunes are present in front of the lava field edge in most areas of the beach (fig 3.), but do not always cover the edge itself. The dune field extends about 3 km to the east from profile A1500 (fig 3.), after that there are sporadic dunes and small vegetated areas on the berm. Between profiles A1 and V500 and west of profile V500 is another dune field that extends to the river pathway, or a small estuary, that is approximately 1 km west of profile V500. The only area of the beach without sand dunes, either in front of the lava edge or on the lower part of the berm, is a 1,5 km wide part within the measured area between profiles V500 and A1500 (fig 2. and 4).





Fig 3 and 4. Fig 3 (to the left) is taken from profile A1500 to the east and shows the dune field in front of the lava edge there. Fig 4 (to the right) shows part of the lava edge where there are no dunes present, between profiles A1 and A1000.

Profile measurements and grain size

The five profiles measured were placed 500 meters apart, with the distance measured along the edge of the lava field and not in a straight line. The berm crest, the highest point of the active beach, was measured in between the profiles as well.

The five profiles were measured from the swash zone to the upper part of the beach ridge and show similar features and grain sizes (fig 5.). The beach face on all profiles was relatively steep, with a high lying berm crest and a well-established berm dipping down towards the beach ridge. The beach ridge itself was the lava edge for profiles A1, A500 and A1000, but on profiles V500 and A1500 there is a dune field in front of the edge. The shortest profiles were also A1, A500 and A1000, with A1000 being the shortest at about 160 meters.

The slope of each profile, from the berm crest down to the lowest measurement, was calculated. All profiles have a similar slope (table 2), especially A1, A500 AND A1000, with a slope of about 3,76-3,81°, while the slope of V500 and especially A1500 is at a lower angle.

Table 2 shows the calculated slope of each profile, from the berm crest to the lowest measured point.

Profile:	V500	A1	A500	A1000	A1500
slope (m)	1/16,2	1/15,2	1/15,0	1/15,2	1/19,6
slope in %	6,2	6,6	6,7	6,6	5,1
slope in °	3,54	3,76	3,81	3,76	2,92

Grain size on the beach was analysed and photographed (fig 5.-10.). Five distinct grain size zones were found on the beach within the measuring area (fig 5.) and are described as follows:

Zone 1 – Lava field.

Zone 2 – beach ridge and sand dunes: 1 mm and smaller grains in a compact layer, often overlain by a thin layer of 1-2 mm grains

Zone 3 – berm: 2-3 mm grain size most common, smaller grain size in-between ripples. Pebbles up to 1,5 cm and sporadic rocks found as well

Zone 4 – upper beach face: 2-3 mm grain size, with 1 mm grains or smaller in-between ripples

Zone 5 – lower beach face: 1 mm grain size or smaller. 2 mm grains also present.

Zone 6 – upper berm: Very poorly sorted sand and gravel, with grain size from less than 1 mm to larger rocks. 2-4 mm grains are most common. Pebbles, rocks and other debris found in high number as well.

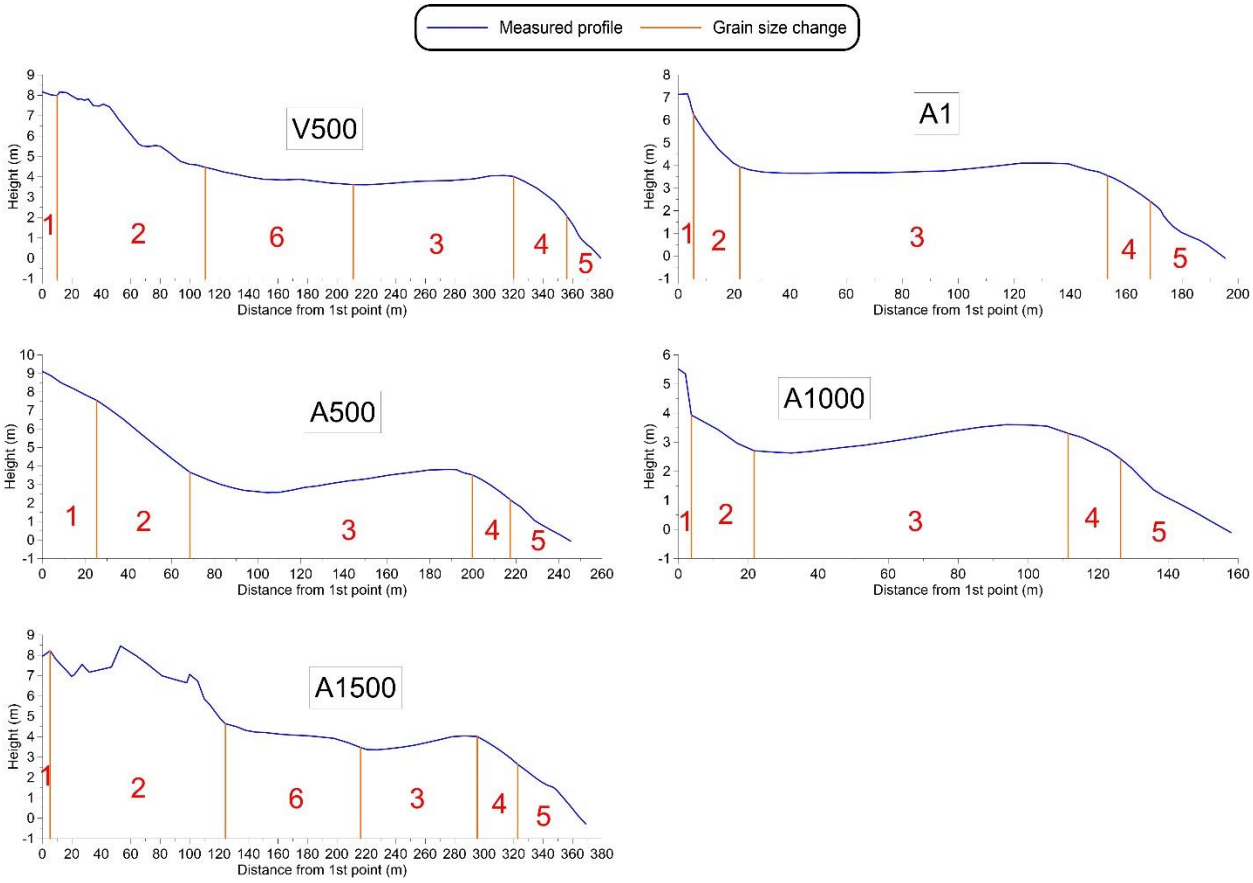


Fig 5 shows the measured profiles at Alviðruhamrar along with the grain size zones.



Fig 6. Zone 2



Fig 7. Zone 3

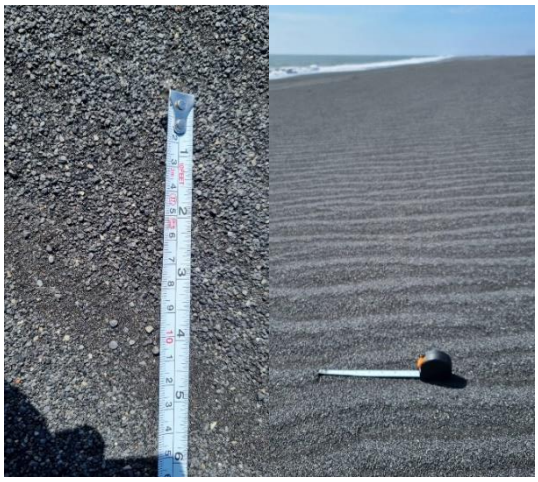


Fig 8. Zone 4



Fig 9. Zone 5



Fig 10. Zone 6

Coastline stability

Although the profile measurements show a relatively wide beach in front of the lava field, the beach there has normally been shorter (fig 11). The 2023 line shows similar beach width as it is today and extends further out than it has been in the past, where the beach has normally been less than 100 meters away from the lave field edge. Furthermore, according to the landowners, the beach within the measured area is not always stable, as large parts of the beach get eroded away during winter storms and waves are able to reach the lava field edge. This is supported by the upper beach having a well-developed dune field with vegetation almost everywhere else on the coastline except within the measured area, although other factors can contribute to the lack of dune development. It is therefore possible that the beach width will decrease again in the future.



Fig 11 shows coastline changes at and around Alviðruhamrar between 1904 and 2023, with the 2023 line extending furthest out near the measured area of the beach. Map is from the Icelandic Road and Coastal Administration.