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Refuge Notebook

Article

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Sudden uplift of the beach recalls ancient landslides
By Ed Berg

Sometime during the night of July 2-3 a geologic uplift several hundred yards long appeared on the beach southeast of Diamond Creek, between Homer and Anchor Point. The lower intertidal zone rose up as much 15 feet, in three elongate mounds. Deep cracks as much as a yard wide ran along axis of the uplift. When I visited the site two days later I could see well-dried algae on the uplifted rocks that indicated that recent tides had not covered them.

Local resident Ken Hahn noticed the uplift early Friday morning, July 3. He climbed up on top and observed that the algae was still wet, which indicated that the algae had not been exposed the previous day and hence that the uplift occurred during the night. The USGS website reported a magnitude 1.9 earthquake at 0754am 6mi NW of Ninilchik, and a magnitude 2.1 earthquake 20 mi ENE of Nikiski at 0606am.

My first impression was that this uplift represented a tectonic event, albeit a small one, compared to the uplifts associated with the 1964 earthquake, for example. The reported earthquakes however were pretty minuscule for an event that apparently shifted bedrock to the surface.

The uplift lies roughly parallel with the bluff, but 50-100 yards out from it. There are old slump and slide deposits at the base of the bluff, and the huge mile-wide Bluff Point slide lies about a half mile further down the coast toward Homer. (The Bluff Point slide forms the large valley on the north side of Baycrest Overlook on the Sterling Highway above Homer).

Could this uplift on the beach somehow be related to old landslides? At the north end of the uplift I could see that the bedrock strata underlying the beach deposits were tipped almost vertically, dipping steeply to the SW, whereas in the exposed bluff face the strata were more or less horizontal. I wondered if I might not be standing on an old slump block that had been beveled off by wave action over a long period of time.

I was also puzzled by the fact that the uplift cut across the regional tectonic trend in the Cook Inlet basin. Our area is under compression on a NW-SE axis because the Pacific Plate is diving under the Kenai Peninsula-Cook Inlet basin in a NW direction. This regional squeeze causes ripples of uplifts and downwarps that run in

SW-NE direction, perpendicular to the compression. The new uplift however cuts almost perpendicularly across this regional grain, which would be most odd for a tectonic feature.

I discussed these observations with geologist Bretwood “Hig” Higman of Seldovia, who suggested that the uplift is a reactivation of an old landslide, probably associated with the Bluff Point slide. The slide could have occurred as long as 17,500 years ago when the ice of the Killey-age glacial advance pulled back into Kachemak Bay from the Bluff Point area. The fact that strata of the local bedrock (Beluga Formation) under the uplift were steeply dipping to the southwest suggested that this bedrock was part of a large slide block that had rotated upward and indeed was slightly overturned.

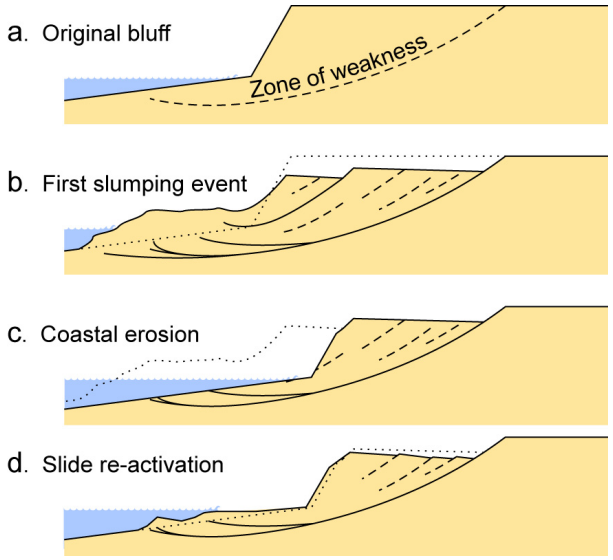
View of the uplifted beach floor with barnacles and dried algae on rocks, looking northwest toward Mt Iliamna. Photo Credit: USFWS/Ed Berg

View of the uplift from the bluff, elevation 700 feet. The uplift is 300-400 yards long, although not all of it is exposed at this stage of the tide, which is about 16.7 feet at this time. Photo Credit:Laurie Daniel

View of the uplift from the south side. The lower intertidal zone has been uplifted about 15 feet. Note that the ocean side presents a steeper face than the landward side, suggesting an upward, clockwise rotation. Photo Credit: USFWS/Ed Berg

Diagram of a possible sequence of events leading up to last week’s uplift of the beach northwest of Homer. The first slumping event could have occurred as long as 17,500 years ago, after glacial ice retreated from the area. Wave erosion in the intertidal zone over thousands of years completely beveled off the original slump, and covered the beach with several feet of sand, silt

and gravel. Last week the slump block began sliding again, probably sinking on top and uplifting the beach below. Diagram Credit: Bretwood Higman



In slope failures it is often the case that a large block slides down a rupture plane which is concave upward. The leading edge of the block rotates upward, and the block moves outward and away from slope from whence it launched. If the strata in the bedrock were initially horizontal, they now dip back toward the slope. You can see this in the Bluff Point slide, where the strata along the beach dip inward toward the bluff, and ponds occupy the void left behind when these strata slid out to their present location at the top of the beach.

Add to this story thousands of years of shore erosion and a few hundred meters of bluff retreat, and you have created a normal looking, gently sloping beach on top of a beveled off slide block. Someday, for some reason, the slide block moves and rotates downward a bit more, forcing the leading edge upward, and viola!, we have an uplift out on the beach.

Hig observed in my photos that the seaward edge of the uplift was steeper than the landward edge. This is exactly what one would expect with a rotating block.

Soldotna geologist Dick Reger pointed out that erosion of a slump block, especially on the beach, changes the distribution of stresses in the block. Material is removed from the bottom (beach) side and material can be deposited as colluvium (slopewash, landslides, etc) on the top side, both of which would tend to make the slide block continue its rotation. He noted that highway construction sometimes reactivates landslides up in the Interior by making a roadcut through the toe of a slide, analogous to beach erosion in our case.

Dick Reger wrote the original paper on the Bluff Point slide in 1979 and concurred that the present uplift is a reactivation of an old slump block. He said that it is possible that there have been many such uplifts along the coast, all of which have been beveled off by thousands of years of very active beach erosion. He too had seen steeply dipping strata in front of the Bluff Point slide, and interpreted this as a beveled off slide block.

There doesn't seem to be any obvious explanation why the uplift occurred at this time. Hig pointed out that this summer has been dry, so pore pressure of water in the rocks would not be high. Slope failures are often facilitated by water-logged bedrock, as with the famous 1967 Grewingk Glacier slide which occurred during one of the wettest Octobers on record.

The uplift is located at 59.6585oN, 151.6764oW for those who would like to view the location on Google Earth or use their GPS to check it out on the ground.
I would like to thank Hig Higman, Dick Reger, Ken Hahn, Laurie Daniel, and Charlie Stock for information and ideas for this article.

Ed Berg has been the ecologist at the Kenai National Wildlife Refuge since 1993. Ed will be teaching his 5-week 1-credit "Geology of Kachemak Bay" course at the Kenai Peninsula College in Soldotna and Homer,

beginning Sept 8 and 10, respectively. You can check on new bird arrivals or report your bird sighting on the Kenai National Wildlife Refuge Birding Hotline (907) 262-2300.

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