

This file is a supplement to:

Doe, N.A., Gabriola's glacial drift—5. Glaciation from Vancouver Island?

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and is a report of a field trip to the Harewood Plain near Nanaimo BC, Canada, to investigate the orientation of the glacial striae there. It was coursework for GEOL-305 at Vancouver Island University and is posted here courtesy of Dr. Steven Earle.

Nick Doe

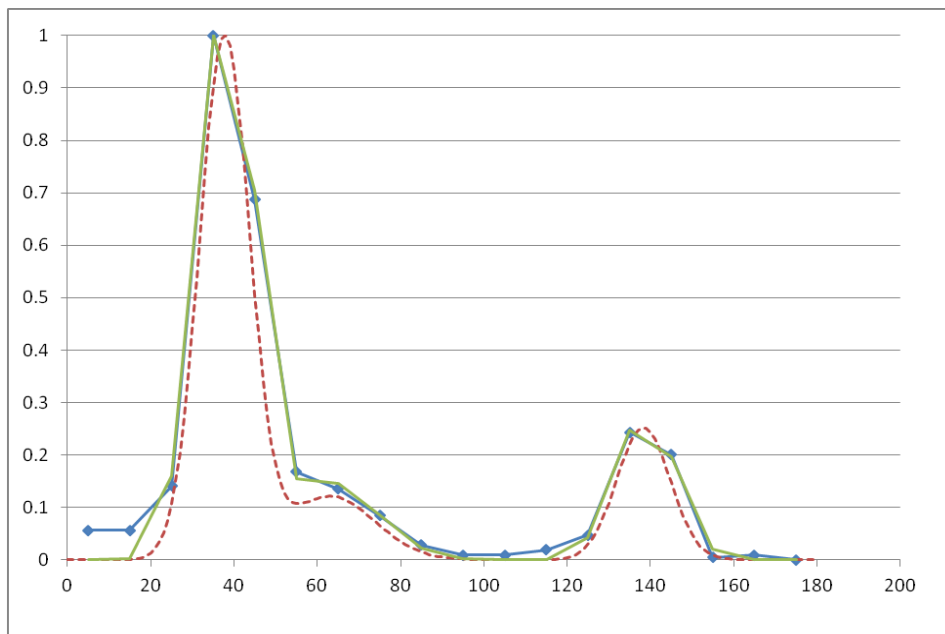
## Investigations into the glacial striae on Harewood Plain (Abyss), Nanaimo

Friday, Nov. 16, 2012

Location: 49°7.767' N, 123°57.857' W, 540 m AMSL

### General

Measurements had been made earlier of the orientation of striae at seven adjacent locations on Harewood Plain (GEOL-305 Lab. 4). An analysis of this data showed that there were certainly two sets of striae, one from the northeast and another from the northwest, but left unresolved was the possibility that there was a third set from the southwest.



If the proposition that there was a third set is accepted, the analysis indicated striae from:

Northeast: N38°E ± 6.0° (38°–218°) relative number of observations 1.00

Northwest: N42°W ± 6.4° (138°–318°) relative number of observations 0.27

Southwest: W27°S ± 10.7° (63°–243°) relative number of observations 0.22

[compass deviation 20°. There were power lines close by, but they didn't affect the compass significantly]

Doubt about the set from the southwest was due to the relatively poor consistency of the orientation  $\pm 10.7^\circ$ , its proximity to the set from the northeast ( $+30^\circ$ ), and the fact that it was only clearly seen at one, possibly two, of the seven locations.

Support for the notion that the set from the southwest should be included in the sets observed on Harewood Plain comes from independent observations on Gabriola Island, where numerous measurements of striae at a dozen sites also indicate three sets with similar orientations.

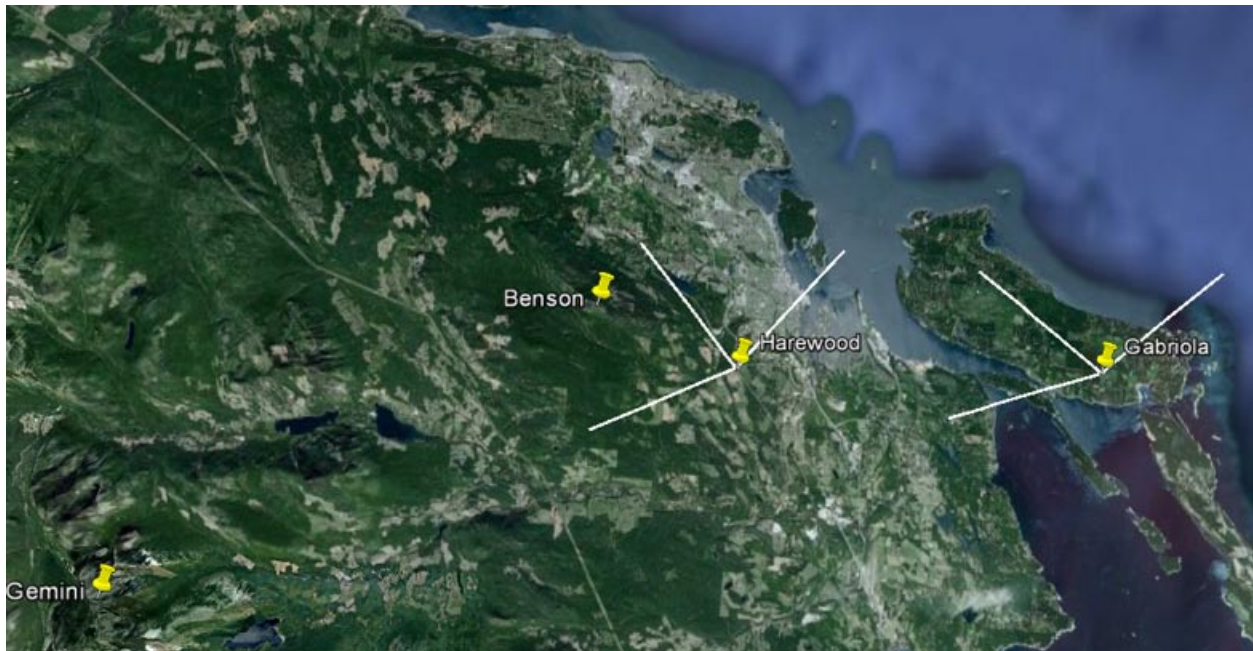
#### Gabriola results

Northeast:  $N47^\circ E \pm 14^\circ$  ( $47^\circ-227^\circ$ )

Northwest:  $N55^\circ W \pm 10^\circ$  ( $125^\circ-305^\circ$ )

Southwest:  $W21^\circ S$  ( $69^\circ-249^\circ$ )

[compass deviation  $19^\circ$ . For  $20^\circ$ , these would be  $N48^\circ E$ ,  $N54^\circ W$ ,  $W20^\circ S$ ].



It is evidence from Gabriola that suggests that the southwest set came from the southwest and not the northeast. No directional information was obtained at Harewood.

On a regional map, correspondence between the Harewood and Gabriola data can be seen to be close.

## Purpose

The objectives of the second visit to the Harewood Plain (Abyss area) were to:

- verify that the striae from the southwest were probably glacial in origin
- if possible see what their relationship to the other two sets of striae was
- locate other outcrops in the vicinity that also showed the southwest set.

## Results

Mixed.

The striae from the southwest are very likely genuine (photographs attached). I saw no reason to dismiss them as being fractures or human artifacts.

They were however too eroded and uncommon for their relationship to the other two sets of striae to be found. This is not unusual. Few crossings of striae give unequivocal evidence as to which came first. In my experience, directional information derived from changing depths of striae (nailheads and others) and crescentic gouges on horizontal surfaces is very unreliable unless the striae are plentiful, which was not the case here. The best information comes from deflection striae on inclined surfaces.

I did however establish that the northeast and supposed southwest set co-exist on some outcrops, meaning that if they were to be due to the same glacier, the direction of the glacier must have changed with time. I find this unlikely. The one from the northeast was very large, and any major change of direction would be recorded elsewhere.

An afternoon's search of the surrounding area failed to reveal any other examples of striae that might be from the southwest. Several reasons from this might be:

- the slope of the site would have been a lee slope, less favourable than on the stoß side
- the conjectured glacier from the southwest would have been the earliest and thus most vulnerable to erosion by later glaciers
- the bedrock further up the hill was mostly gritty sandstone to pebbly conglomerate, which does not preserve faint striae
- the logging roads had been paved with crushed sandstone, possibly burying striaed outcrops
- the glacier was small and didn't leave many traces.

This was the same situation as seen on Gabriola where striae from the southwest were only clearly visible at a few sites.

## Photographs

Arrows indicate presumed ice flow direction and annotations the apparent direction of the source of the ice. Except where indicated, sites are at, or very close to, the GEOL-305 sites. All surfaces were horizontal and sandstone.

My compass is set for 19° deviation.



Compass set at  $315^\circ$  ( $N45^\circ W$  moving SE down the page).

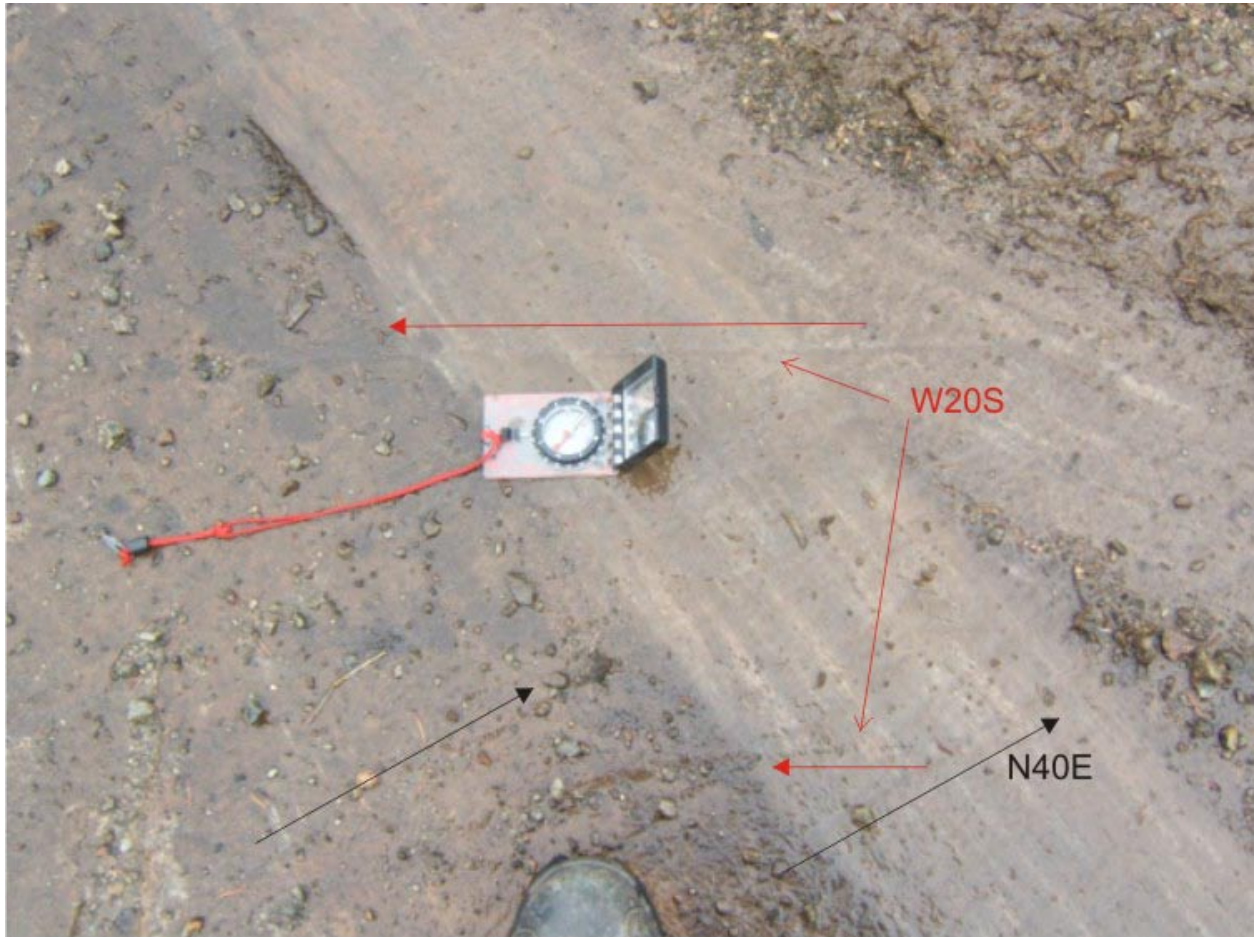
A possible example of a nailhead stria (type 1) indicating ice movement from the northwest.

Nailhead striae (striae terminating abruptly on the down-ice side) are common on sandstone bedrock, but rarer on granite bedrock where you also see type 2 (becoming deeper and then shallower) and type 3 (reverse nailheads). Type 3 on sandstone is usually a deflection stria on an inclined surface, not the situation here.

Striae from the northwest sometimes show what might be “micro-plucking” on the edges away from the northeast (on the right side here) but it does require imagination to see this.



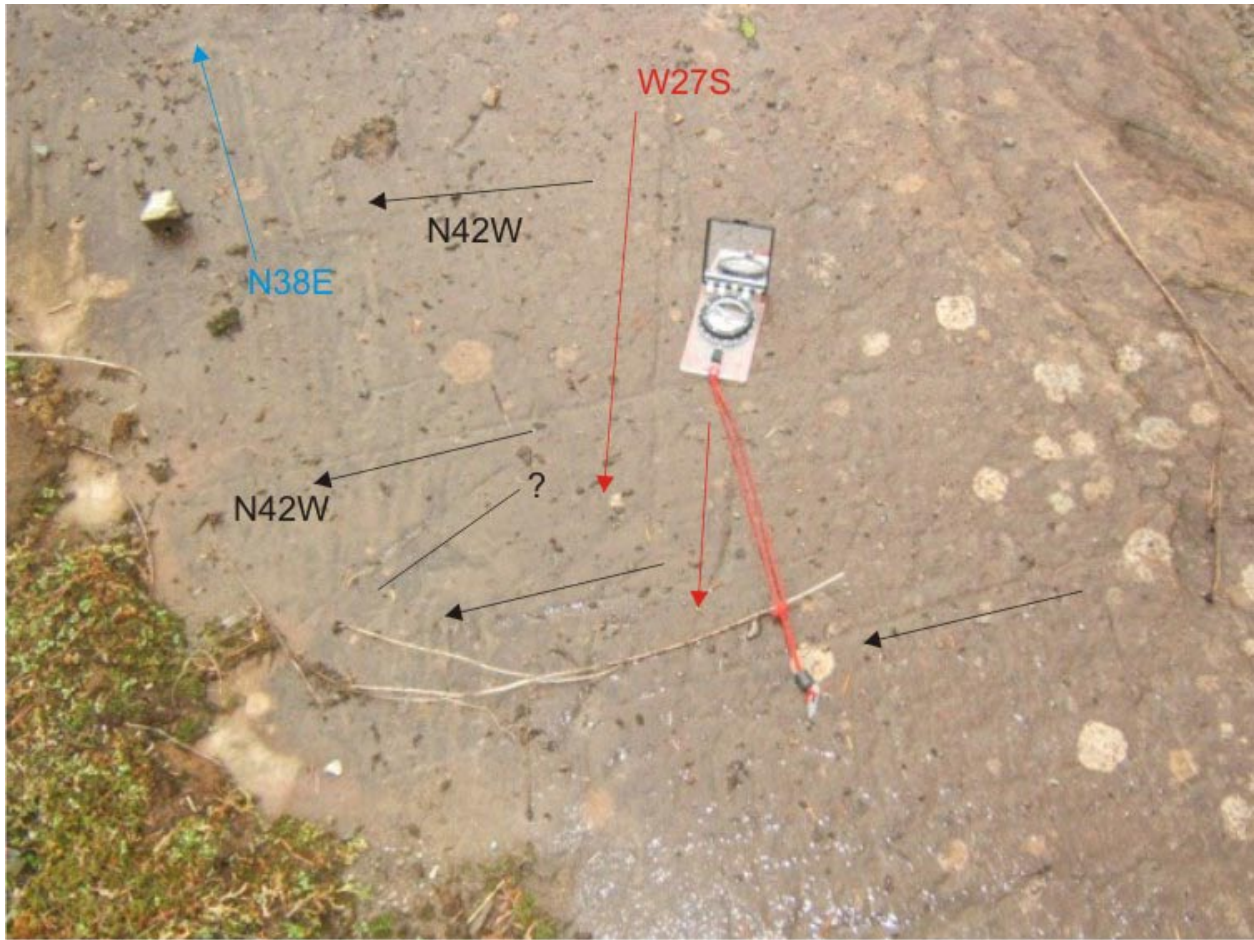




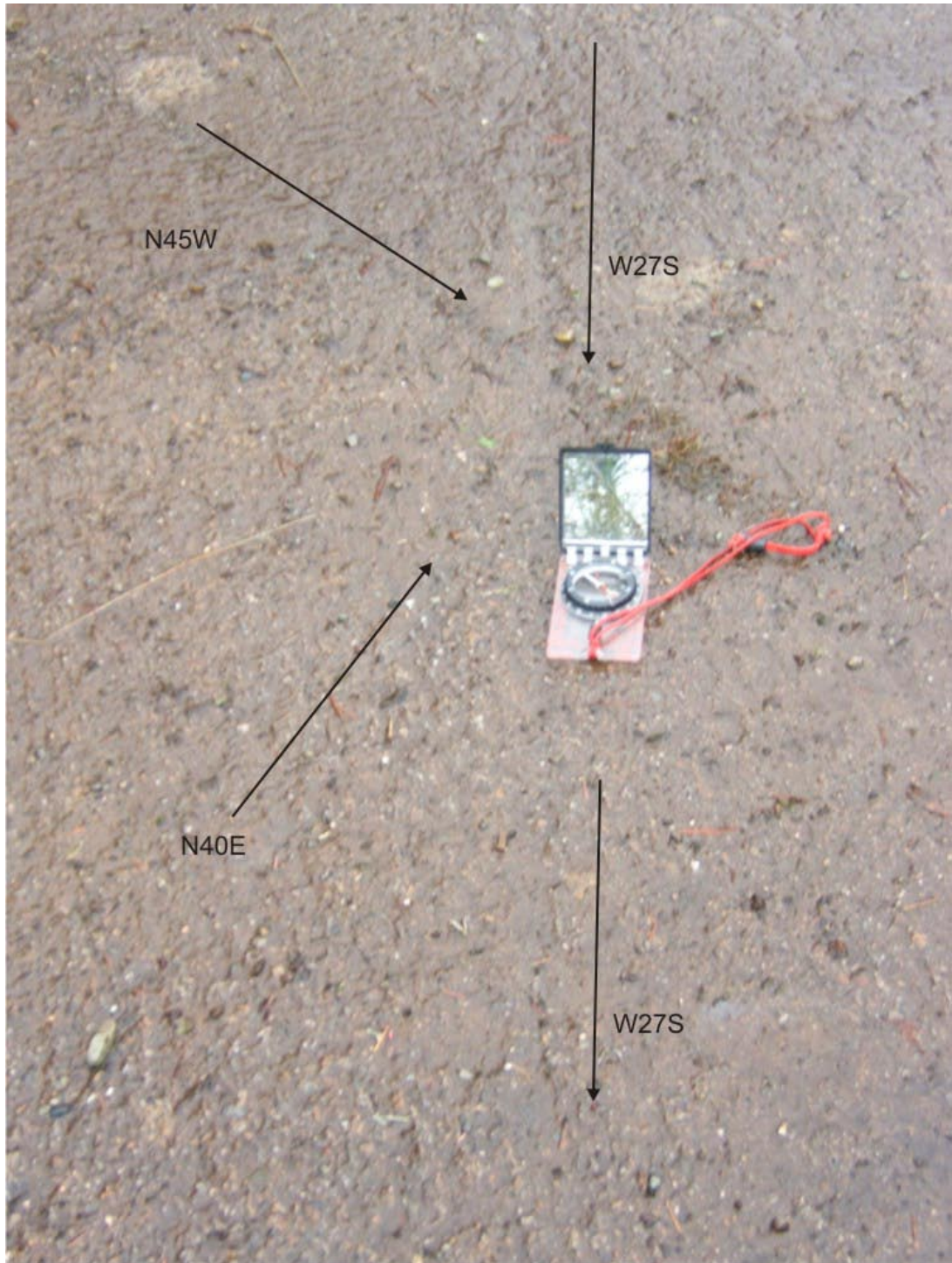
The broad strip is a tire track in the direction of the path. As a general rule, I discount striae running exactly only the long axes of paths. Too easily created by vehicles.

If I must count them, I check where the path bends, or in outcrops a short distance off the path, or, if really desperate, under soil at the edges of the path.





A confusing site. Some unexplained orientations not seen anywhere else. The northeast set is not much in evidence on this patch, but is visible a short distance away.

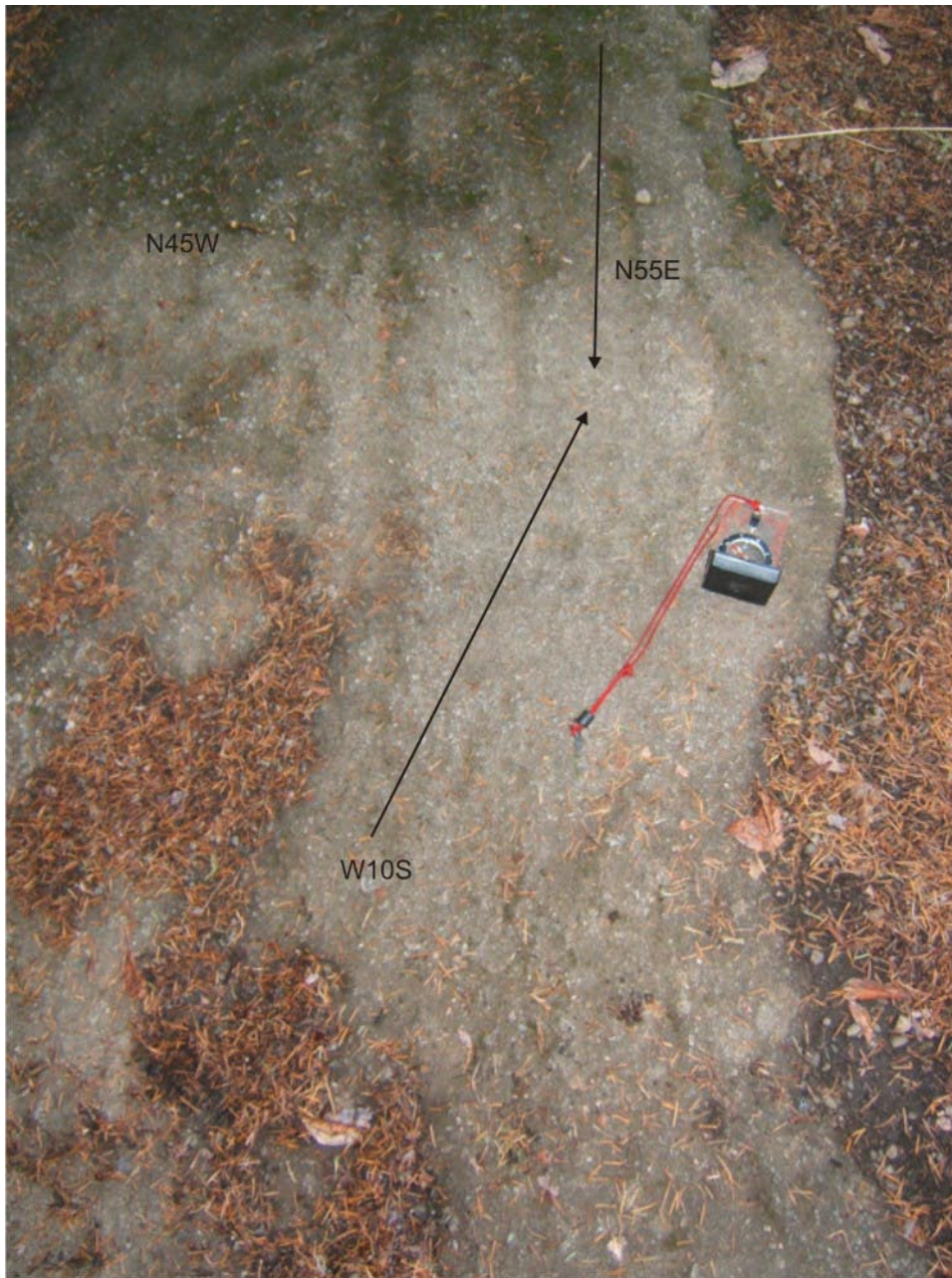


One of the few places where all three sets were visible and intersecting. Unfortunately, the gritty bedrock doesn't help sort out what went on at the cross-over.





Compass set for  $W20^{\circ}S$ , so these are those. But which direction? You see what you want to see, as at almost everywhere.



One of the few pictures taken away from the GEOL-305 site. This one is near the abyss. It shows a typical “what-might-be-a-SW striae set”. The compass is (optimistically) set for W20°S. I wouldn’t normally count these though.

As at most places further up the hill and along the crest from the GEOL-305 site, the striae mostly appear to be NE.