

## Past climate and glaciation of the Drakensberg Mountains, southern Africa

### Lesson two: Data analysis: interpreting images and sketch maps from the High Drakensberg

#### Starter Questions with answers

In pairs, attempt to answer the following questions as you and your partner discuss and interpret the images. (*See the Lesson 2 Starter PowerPoint slides.*)

Starting assumption: it was colder than today in the Drakensberg during the LGM (see Lesson 1) and therefore glaciers may have formed in the Drakensberg during this time.

Questions:

- What are the physical similarities between the two areas? What are the physical differences? (*Hint: think of relief, elevation, and slope aspect.*)

Similarities include sheltered areas behind relatively steep slopes in mountainous terrain. In both cases, the curvature of the cliffs look a bit like what we might expect for areas where cirque glaciers might develop. Differences include elevation (the Leqooa area is a lot higher than the Mount Enterprise area – about 3,100m compared with about 2,100m.) The aspect of Leqooa is facing south (shadiest situation in the Southern Hemisphere) compared with Mount Enterprise where the aspect is east.

- Do you see anything in the photos which might suggest the existence of a past glacier at either, or both, areas? Describe the evidence you can identify, and what you think it may represent.

Ridges at Leqooa are very evident from the lower altitude satellite image and aerial photo. These look like lateral moraines that could have been formed along the sides of a former cirque glacier. The location of a possible outwash fan below the ridges is also indicated. There's also snow in the Google Earth screenshot of Leqooa, suggesting an area where snow stays on the ground for longer than elsewhere – favourable situation for snow accumulation under a colder climate.

Other than looking vaguely cirque like, the Mount Enterprise area in the Google Earth screenshot does not have obvious evidence for past glaciation. However the photo shows a ridge that looks like a moraine (however, note that it could also be the product of mass movement). The ridges at this site are much more subdued.

- What would we need to do in terms of field work to test whether our impressions from the photographs are correct?

We would need to visit the area and sample the ridges to see whether they really are the product of past glaciation or have resulted from some other process. For example, if they represent moraines, then the material making up the ridges should have the characteristics of till (unsorted, with a range of particle sizes, and unstratified). We might also expect the

individual pieces of rock (clasts) making up the deposit to show evidence of having been transported by ice (for instance being rounded, having striations and/or being oriented in a particular direction relating to the former ice flow).

- Which of the two areas do you think is most likely to yield positive evidence for past glaciation and why?

The Leqooa area is most likely (and has) yielded positive evidence for past glaciation. Its higher elevation and south facing aspect would have made it a colder environment during the LGM than the Mount Enterprise area, and it's more likely that sufficient snow would have survived the summers here to build up a cirque glacier.

The Mount Enterprise site is at a much lower elevation, and the landforms in this area appear to be much more subdued. There are areas to the north-west of the site that are higher in elevation and south-east facing but have no evidence for glaciation despite being in a more suitable location.

- What difference would it make for our past climate reconstruction if the evidence from either, or both, of the areas turned out to be the result of periglacial processes instead of glacial processes?

Both glacial and periglacial evidence indicates that the climate was colder in the past than it is now. However, for glaciers to have formed, precipitation would need to have been higher (periglacial features can form in places of relatively low precipitation). Therefore, the main impact on our palaeoclimatic reconstruction would be about how much precipitation there was. Our other interpretation would be that although colder during the LGM, it was *not cold enough* to enable glaciers to form under low precipitation conditions. (Remember that glaciers can form under low precipitation conditions, but it has to be *even colder* for this to happen in comparison with places where snowfall is high.)

The most likely scenario is that a glacier did form at Leqooa during the LGM, but it is less likely at Mount Enterprise. This suggests that the temperature drop during the LGM was large enough to support glaciers at higher elevations in the Drakensberg, but probably not much further down than around 3,000m.