The effects of coastal erosion on the remains of Wheal Droskyn and Wheal Ramoth in Perranpoth, Cornwall

Perranporth is a small town located on the North coast of Cornwall. It features a long beach with cliffs that are exposed to strong winds from the Atlantic Ocean. A large number of arches and sea caves can be found along the shoreline. I chose to carry out my project in this location because of the relevant coastal structures that can be found there but also because these structures are very accessible.

My initial project idea was to study the geomorphology of Perran Bay and find out why certain features are shaped the way they are. However this idea had to be changes because of the human activity that has influenced the evolution of those features. The cliffs have been exploited for tin and copper for a long period of time until approximately two hundred years ago, when the mining stopped. This mining activity has left behind the large number of caves and arches I mentioned earlier. Mining consisted in digging drainage tunnels, also called adits, in the cliff in order to expose the lode and allow exploitation of the main ore, which is cassiterite.

With the help of the Katie Wilkinson Research Scholarship I was able to travel to Perranporth and spend one week to carry out fieldwork and collect data for my final project.

I was particularly interested in arches so I chose to examine two of this type of structures that were formed by the exploitation of two different mines. These are called Wheal Droskyn and Wheal Ramoth each one being located on either side of Perran Bay. The aim of my project was to compare these man made structures to sea arches that occur naturally on a coastal environment being carved by the sea and wind.

The main characteristic of natural sea arches is that they occur almost always in sedimentary rock as a result of erosion of sea caves. They become stacks as the erosion process continues. In my case the structures were formed in metamorphic rock. During my fieldwork I collected orientation data (dips and strikes) from the two man made arches and also took rock samples to examine their geology. I wanted to investigate if the orientation with respect to the shoreline and the rock that makes up the structures makes them erode in a particular way unlike natural sea arches. If this were true then the man made ones would start to erode from the base and not become sea stacks.

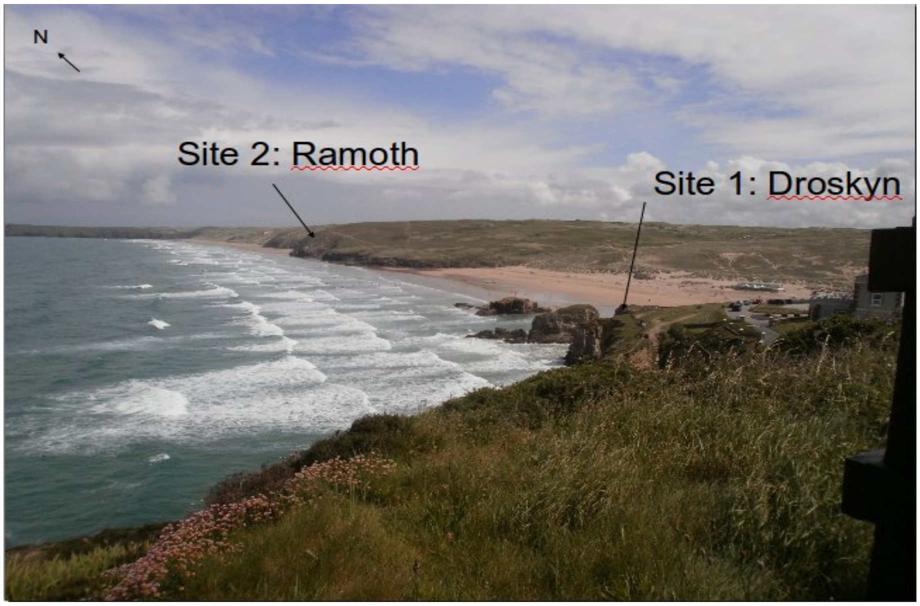

Figure 1: Locations of Wheal Droskyn and Wheal Ramoth on Perran Bay

The arches that I chose to examine were both composed of metamorphic rock and the one from Wheal Droskyn was a lot harder than the one from Wheal Ramoth. The former featured approximately 20 discontinuities in the rock, that were up to 0.6 meters deep. Ramoth on the other hand was a lot more compact with very few large discontinuities, however because it was made of slate its rock had a tendency to split easily in very small platy pieces because of the numerous parallel weakness planes that this type of rock features.

Figure 2: The arch from Wheal Droskyn

Figure 3: The arch from Wheal Ramoth

After collecting the field data I had to point out which of the discontinuity planes and weaknesses are in fact statistically significant and likely to favor a more pronounced erosion. To do this I used the software GEOrient to plot the orientation data on stereonets. This helped me to group them into clusters and identify the most common orientation of the planes. In other words this shows where exactly erosion is most pronounced.

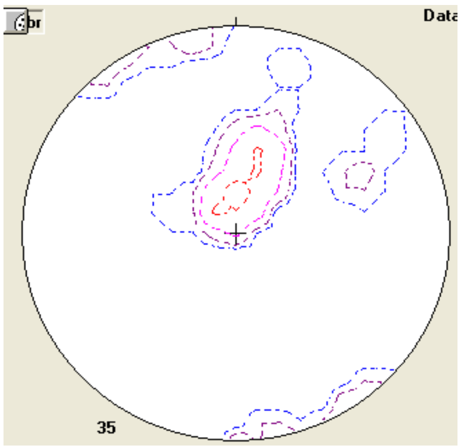

Figure 4: GEOrient stereographic projection of the orientation data showing the main clusters.

I also carried out a kinematic analysis of slope stability and identified too types of possible failure in the rock. This can be either plane failure where a single plane of rock from the surface slides away, or wedge failure where rock may slide because of the intersection of two weakness planes.
The kinematic analysis allowed me to establish a safety factor for every potential weakness plane that I recorded in the field and thus show if the particular plane will cause sliding in the rock or not. The results show that a softer structure with a larger number of small discontinuity planes is more likely to erode quicker than a harder one with deep and large discontinuities.

I am very grateful for help I received from the Katie Wilkinson Research Scholarship as it made this field trip possible. During my week in Perranporth I had the opportunity to carry out my own research and gained valuable fieldwork skills that I did not obtain from other field trips as I could not participate in them. I have become a lot more confident in working on my own, managing my time and making my own observations and opinions.