Island Arc Magmatism: Santorini

Santorini: The Eastern Cliff

Narrator:
Returning to the outcrop geology, let's take up the story on the eastern cliff of the caldera underneath Santorini's modern capital, Fira. Superficially the pink bands on this rock look as if they may be directly related to its formation but, in fact, they turn out just to be secondary features. The true origin of this 79,000 year old deposit presents a far more intriguing puzzle.

Dr Richard Thorpe:
This distinctive black and pink striped layer is a very special sort of pyroclastic rock. The bottom of this layer is fairly sharp; in fact, it's overlying a series of older, weathered volcanic rocks. The lowermost part of the layer is composed mainly of blocks of dark vesicular andesite called scoria. There are also some lithic fragments, and because the layer is fairly well sorted, we can call it an airfall deposit. However, it passes up without a break into dark welded material. We assume this is part of the same deposit, and so we can term this a welded airfall deposit. And the significance of this rock is that we think it represents a very explosive eruption of very hot material from a vent perhaps within a kilometre of here.

Narrator:
Further up the succession the dark crags are rhyolite lavas which erupted 18,000 years ago. On the face of it the volcano was getting more silica rich as we approach the present day. The interior of these thick flows are exposed because they were cut through by the formation of the caldera. Close up you can make out the flow banding which formed when the lava was being erupted. But there are other flow features in these lavas as well. These tension gashes are caused by shearing within the lava flow and are only found in the hot ductile interior. The motion here is top to the right, bottom to the left, pulling open the cracks which you see developed. These rhyolites rest on top of a lava pile that you'll know very well from the Course text. This is the succession of lava lying to the west of Fira at Skaros. Quite impressive, isn't it? The 250 metre Skaros cliff indicates that a subduction zone volcano erupts a significant amount of lava as well as the pyroclastics. At the base of the succession the sea cliff is a thick andesite flow, followed by layer on layer of lava, as each eruption added to the sequence, recording in all about thirty volcanic events. Looking with the sun, we can see the margins of each flow picked out by red layers. Close examination of these shows thin bands of rubble which have partially oxidised, unlike the massive interior of the flow. The chemical composition of many of these basalts and andesites show that fractional crystallisation took place within a magma chamber. But this is not always the whole story. Let's look at a thin section taken from one of the andesite layers. The corroded nature of this plagioclase crystal implies that it was not in chemical or thermal equilibrium with the magma. Also, the groundmass has a blotchy appearance. Dark patches are intermingled with lighter areas. This texture is reminiscent of two liquids being stirred together. Taken with the evidence from the corroded plagioclase crystal, this sample is interpreted to come from a mixed magma formed by hybridization of a basalt with an andesite within the magma chamber.