Island Arc Magmatism: Santorini

Welcome to Santorini

Narrator:
The Greek Island Santorini, famous for its sun and lava… but it's the lava that we've come to see. In this video we invite you to consider yourself on a field trip to this new piece of continental crust – an island arc volcano. Santorini forms several islands, which form part of a single volcanic complex. First we'll interpret the surface geology, then we'll delve beneath the volcano and consider a model of the subvolcanic processes which determine its magnetic output. Santorini is a good place to study volcanism related to subduction because the volcano is still active. This lava flow erupted in 1926 and is part of the central island, Nea Kameni. The present day active focus of volcanism is evident from recent craters which relate to different lava flows… clearly indicated by different weathering patterns… and these have built up the central cone… which is at the hub of the whole volcano. The islands fit into a circle approximately 16 kilometres across. The volcano cliffs range up to 300 metres above sea level, and the sunken depression is about 300 metres deep, much deeper than the surrounding sea. On this trip we'll visit localities at Therasia, Oia, Skaros, Fire, the Kameni Islands, and Athinios, Akrotiri and Faros in the south. Near the Faros lighthouse some of the oldest rocks are exposed at sea level. Here we can study the earliest eruptions and start to understand the volcano's growth. The exposures show pillows and blocks of black basalt in a fine-grained matrix. Note the chaotic assemblage. So we might think these were erupted subaerially.

Dr Steve Blake:
On the other hand, there are also large cross-bedded structures in these rocks, which indicate that sedimentary processes must have been important during this eruption. We can imagine how these rocks could have formed under the sea, where an eruption of basalt would have created large pods of lava, as well as ash, and a mixture of those, together with the water could form a slurry which could move downhill and form these large structures that we see here. These rocks formed in an early part of Santorini's history when the volcano was still being built from under the sea. After the rocks formed, a period of uplift must have occurred to bring these rocks to the level we find them. On this side of the cliff is a sequence of subaerially erupted rocks, and they provide a history of part of Santorini's younger evolution. They also show some classic volcanic features, so let's go and have a look at them. Working up from the base of the succession, one of the first layers we find is this layer of black and red scoria. It is just the sort of thing we'd expect from basaltic or andesitic eruptions at island arc volcanoes. You can see some of the fragments are rather large so we must be quite close to the vent here. However, the fragments aren't welded together so maybe the eruption was rather slow, lasting several days, or maybe even weeks, so that the bombs and scoria didn't fuse together. One of the exciting things about the rock is that it's crowded with plutonic and volcanic xenoliths that have contaminated the magma.

Narrator:
A thin section shows one of the plutonic xenoliths enclosed by the lava. You can tell this from the large crystal size and absence of any groundmass in the xenolith when you examine it in close-up.