Rocks in the field

Metamorphism of rocks

GLYNDA:
Another magma -this time an intrusion. But how do we know?

TONY:
A first sight an exposure like this can slightly confusing, If I look at this distinctive face here for example, this is actually a product of weathering, there are also some rather nice little patches of yellow and creamy white material that I can see in the foreground here, and on the rocks here. But these are organic, they are actually encrusting the surface and they are lichen. What I really need to look at this rock properly is a fresh surface. This is one of my favourite localities for looking at igneous rocks. It a superb rock to study in the field, it's so coarse grained, you can see a lot of detail even with the naked eye. I can pick out white minerals, I can pick out black minerals. When I combine with the hand lens I can see that these white minerals are long and elongated, they've a cleavage which tells me it's almost certainly a feldspar, possible plagioclase. The black mineral is very shiny, it has some good flat cleavage plains as well and it's probably a pyroxene. ... Now I can see a third mineral, a green glassy mineral -it has no cleavage and I think it is probably olivine.

In addition there's a fourth mineral forming large patches within the rock. These are zeolite minerals that develop in cavities, as the magma cool, gas that has had evolved created bubbles, if you like, spaces within the newly formed rock and these are later mineralised, in this case by these white minerals here. And it's these that are largely responsible for this very distinctive lumpy texture that we've got because on the open surface they're actually weathering away very easily and leave the pyroxene standing out to form the lumps. But if I look at the face behind me I can see that there is a second type of rock in this body -it's slightly different and I think that we should have a look at that now. I've now lost the lumpy texture that I could see at the previous spot -it's still very coarse grained but now it's quite even grained. On the fresh surface the mineralogy is the same. On the weathered surface the brown patches are actually the olivines that have been oxidised. What I'm dealing with here is a dolerite -and intrusive igneous rock And what we've now got to consider is what type of igneous rock.

The coarseness suggests it's possibly a pluton, it could be a sill or a dyke, and what I really need is to identify a contact in order to determine the field relationships between this rock and the country rock.

GLYNDA:
The country rock into which the igneous rock has been intruded is only a couple of hundred of metres away. These predominantly grey coloured and layered rocks (originally sediments) predate the intrusion by more than a hundred million years. At the contact erosion by the sea has exposed only a single bed of the grey sedimentary rock -overlying the dolerite -the brown weathered surface of which is only just visible in the foreground. The contact of the dolerite with the grey rock is not flat. In places it is bulged upwards showing that the country rock was heated to the point were it started to deform plastically. And you can just make out a glassy rind at the contact itself. This is what we call a 'chilled margin'. Just below the chilled margin the dolerite is fine grained-much more like the dolerite in this thin section, compared with the coarsely crystalline texture in the example that Tony showed you earlier.The heat from the intrusion has clearly altered the grey sediments. They have become brittle and if we could hammer them ¬which we can't at this protected site -you would find they would be very hard and splintery. Some recrystallisation must have occurred -and must be associated with

metamorphism at the contact with the hot doleritic magma. These sediments have developed a 'hornfels' texture. And we have left until last the most convincing evidence that this hornfels was once a sedimentary rock On the bedding planes we find marine fossils -They're ammonites. The concordant relationship between the bedding and the intrusion proves it is a sill -and we're looking at the top of the sill here. An aerial view of the whole sill at Portrush - exposed like this because nearly all the surrounding country rock has been eroded away but not quite all. Just a tiny amount of the 'one-time sediments' still remain on the other side of the sill.