The Pinnacles

The Mystery of the bands in Fraser Island's Coloured Sands

Some of the more spectacular features of Fraser Island are its exposed cliffs of coloured sands. Inevitably when groups of people see these stunning exposures they become curious about how they were derived. We know that the red/orange colouring agent is iron in various intensities.

A film of iron compounds (sequi-oxides) encapsulate many of the grains of silica sand. These oxides over time get stripped off the surface layers. The organic acids derived from plant detritus accelerate this process. The stripped iron oxides are deposited in the lower levels of the soil and build up both concentrations of colour and nutrient in the "B" horizon of the evolving podzol soil. The deeper down in the soil profile usually the greater the thickness of the "B" horizon and its richness in colour are. However there is usually no sharp division between the white "A" horizon and the deeper yellow to pale orange "B" horizon.

Until now the best theory for the coloured sands was that due to immersion and consolidation of the sands over eons the same process involved in the formation of the "B" horizon caused extra concentration of iron oxides to display those characteristic colours that have resulted in the stunning coloured sands exposures of both Fraser Island and Cooloola. In the absence of any other theory this has been the accepted wisdom. However it doesn't explain those many bands of iron running through cliffs like The Pinnacles with sharp demarcation between different reds than is found in any "B" horizon and sharp definitions that are uncharacteristic of usual soil profiles.

The best example of a "B" horizon coloured sands are found at Arch and Yathon Cliffs on Fraser Island's western shores. Here however, though the colours don't match those found at the Cathedrals and many of the exposures along Rainbow and Teewah Beaches and there is no iron-cemented sand as at The Pinnacles.

In October 2008 FIDO made a fascinating observation of coloured sands at Hammerstone Sandblow right beside the northern walking track from the Ocean Beach into Wabby Lakes. Here we observed deep red sand in an area that less than 50 years ago would have been loose aeolian beach coloured sands. We were stunned by our discovery. The depth of the deeper rusty colour went down about 20 cms

The stunted pioneer vegetation of wattles, casuarinas, and Jacksonias growing here are testimony to just how undeveloped the soil is and how recently it has been colonized by plants. On closer examination FIDO was surprised to see that the coloured sand was lying below what we recognized as a cryptobiotic crust.

Cryptobiotic crusts occur in soil or rocky surfaces in dry regions around the world. Similar cryptobiotic crusts have been observed in Mungo National Park growing on sand in an arid area. Cyanobacteria are the most important components of this crust. Cryptobiotic soil crusts are important. They help keep the soil firm. They stop wind and water from moving the dirt. They also help feed and water the soil. Large colonies of cyanobacteria are also the basis of stromatolites. Cyanobacteria use water, carbon dioxide, and sunlight to create their food. Oxygen is a by-product of this process. The crust observed at Hammerstone Sandblow is not too dissimilar to the stromatolites observed at Shark Bay. Land managers globally are aware of the significance of these cryptobiotic crusts and try to prevent them being broken by any form of trampling or traffic. People are exhorted to stick to formed paths where such crusts exist to prevent their destruction.

FIDO has been watching the development of this cryptobiotic crust in Hammerstone Sandblow for several years but in October 2008 the discovery of the coloured sand below the crust caused us to take an even much closer look at them especially having made a special note just previously of similar features in Western Australia.

Small hard lumps like dead coral appear above the surface as the sand erodes away.

A closer look at a small colony of cyanobacteria vaguely resembling small stromatolites

The cyanobacterial clusters fall well short of the cryptobiotic crust in other parts of Hammerstone.

We returned to more closely examine the cryptobiotic crust overlaying the coloured sands observed earlier However where this crust was breaking up due to some natural erosion it was possible to see very clearly some richer orange deep colour and this seemed to be the colour leaching into the sand below resulting in “coloured sands” in what had been only a few decades earlier wind-blown sand.

The above two photographs show the cryptobiotic crust breaking up and already revealing high concentrations of iron. While these lumps were relatively crumbly it is not too hard to imagine that if another layer of sand were blown over the top of this crust that this layer could become squeezed and hardened into hard layers of iron-sand lying above richer coloured sands and this could result in roughly horizontal bands similar to those seen at The Pinnacles and other Great Sandy Region coloured sands exposures.

What remains to be explained is how so much iron was concentrated in these colonies of cyanobacteria in such a small time span. Some mysteries of the coloured sands of Fraser Island and Cooloola have been solved. New riddles have now been created. When they are solved they may help explain the rich colours occurring in coloured sands globally as well as in Queensland’s Great Sandy Region.