Vulkathunha-Gammon Ranges National Park   Oocaboolina Outstation Hut

Oocaboolina Hut (white rectangle in Fig 1) is about 6km east of Nepabunna on the north side of the Gammon Ranges Road, about 200m north of the road.   Geologically it is situated on the southern limb of a large east-west elongated syncline.

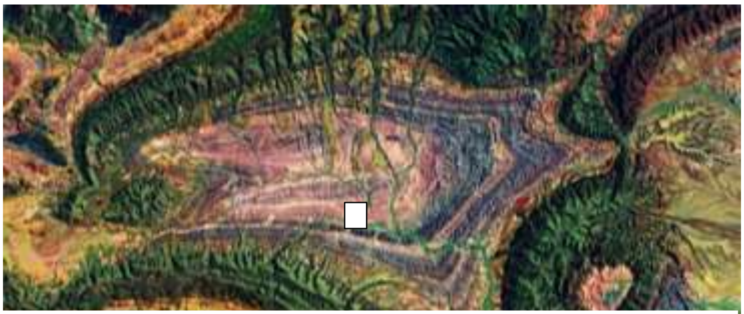

Figure 1

These sedimentary rocks were formed in the early part of the Cambrian Period, when a biological explosion of the first multicellular life forms occurred after the warming of the climate. The previous 200Ma years were of Ice Age conditions all over the earth, called the Cryogenian Period. No vegetation existed on earth at this time and the erosion of rocks and sediments by rivers off the land was much more intense and vigorous, enabling large quantities of sediments to be carried into sedimentary basins.

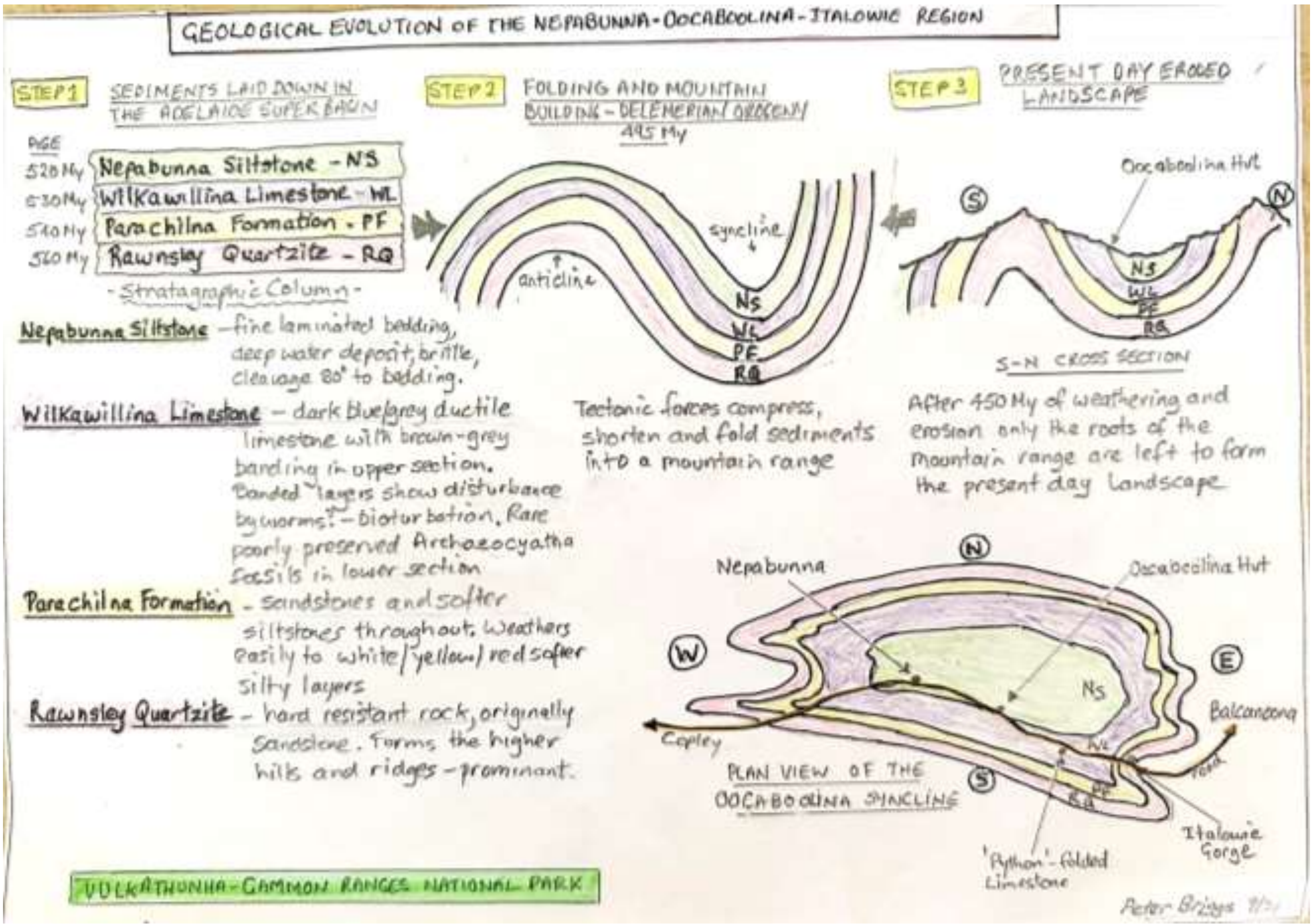

Figure 2

The hut (fig 3) is almost in the middle of a large elongated syncline as shown in the diagram above. The hard resistant Rawnsley Quartzite forms an outer surrounding rim of higher hills and Oocaboolina Hut is situated in near the middle of this basin structure.   Wilpena Pound is another example of a syncline basin.

Figure 3

The rocks in the immediate vicinity of the Hut are the Nepabunna Siltstone (fig 4) which outcrops in the small hills immediately adjacent the Hut. This calcareous siltstone has a fine, laminated (2-4mm) bedding, dipping to the south but also heavily fractured by near vertical cleavage which is almost 80 degrees to the sedimentary bedding plane. This gives rise to the sharp flat scree. The fine sediments that formed this siltstone indicates a deeper water

Figure 4

Figure 5

environment with some calcium carbonate precipitation.

The left photo (fig 4) shows the fine bedding while the right photo (fig 5) shows the dominant cleavage which produces sharp fractures on the exposed surfaces.

This cleavage would have been a result of a later secondary folding event in the syncline. Brittle siltstones are not able to absorb tectonic stresses and tensions during tectonic pressure and hence fracture to form this striking near vertical cleavage. The same tectonic pressures have a different effect on the limestone, which is more ductile and folds. This secondary folding would have occurred soon after the major folding event (Delamerian Orogeny) while the beds were still buried and subject to some heat and pressure.

From the satellite image (fig 1) and the sketch (fig 2), you can see that the geology in this area forms a syncline, an elongated basin shape, trending east-west. The stratigraphy becomes older as one moves outwards from the center to the older rim formed by the Rawnsley Quartzite. The road near the hut follows the boundary between the Nepabunna Siltstone and the Wilkawillina Limestone. The contact is not visible but probably hidden under the creek bed.

On the south side of the road the stratigraphy moves into the older Wilkawillina Limestone with low hills rising to the south. This limestone deposit is banded to begin with. The bands alternate between dark grey to buff/brown and are about 20-30mm thick (fig 6 & 7). This periodic change in colour is probably a seasonal effect at the time of

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Figure 6 & 7

deposition. The grey band accumulates more calcium carbonate, while the brown layers maybe dolomitic with inclusion of iron minerals. This seasonal difference may be due to temperature variations during the year which influence the precipitation of the minerals calcium carbonate and calcium magnesium carbonate (dolomite) and dissolved Iron. The colour differentiation in the bands would have developed later when the sediments became compressed and harden in a process called diagenesis.

Another distinctive feature of the banded limestone is the disturbance and breaking up of the layers by burrowing animals like worms, this is called bioturbation (fig 7). Such disturbances show an active biological activity in the depositional environment in this early period of the earth's history.

The low hills south of the road, across the creek consist of this banded Wilkawillina Limestone, dipping approximately 45 degrees to the north, the same dip orientation as the Nepabunna Siltstone seen on the northern side of the road. Climbing the low hills the stratigraphy and rocks are getting older and dipping to the north. If one continues for three kilometres in this direction you would pass into the older Parachilna formation, and even further south in the distance you can see a line of higher hills, which is the more resistant and older Rawnsley Quartzite. In other words you are climbing up the southern side of the syncline crossing over formations that get older.

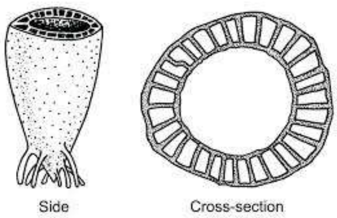

Figure 8

Mid way into the Wilkawillina Limestone it is no longer banded but becomes hard and dark grey. At this level some poorly preserved Archaeocyatha fossils (fig 8) can be found. These were a cone shaped sponge filter feeder with double walls connected by radiating structures and are common to the Wilkawillina Limestone in other locations (eg Wilkawillina Gorge, Brachina Gorge). When they die, they tumble over into different orientations. These ones are not as clearly defined due to poor preservation, but enough exist to convince one of their presences. Archaeocyatha means 'ancient cup shape'.

Archaeocyatha are considered important index fossils in geology because they existed only in the early Cambrian, the beginning of multi-cellar life and had a world-wide distribution. Then all of a sudden, they became extinct. Archaeocyatha fossils can confidently date the rocks to the early Cambrian.

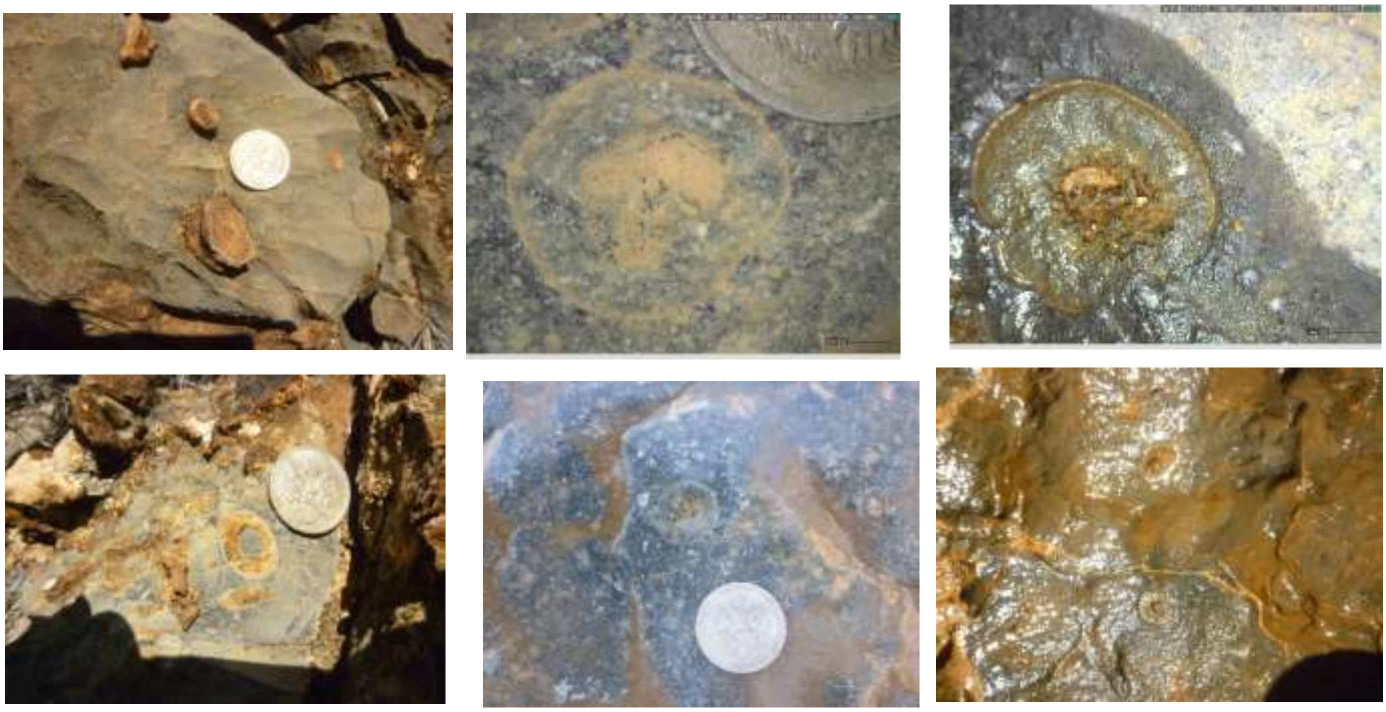

Figure 9

Photos (fig 9) above shows these fossils were fossilized by replacing the original material with calcium carbonate and dolomite. Today, rain water with dissolved atmospheric carbon dioxide will slowly dissolve the limestone (calcium carbonate) but the dolomite is much more resistant. Hence, the Archaeocyatha become prominent when the limestone around them dissolves, leaving the harder brown dolomitic Archaeocyatha in relief. The limestone is scattered with these brown dolomitic Archaeocyatha fragments, standing out in relief due to differential chemical weathering. The depositional environment here did not favour fossilization, so very few where preserved (maybe 0.1%), others fragmented to form brown etchings on the blue/grey limestone exposed surface.

Moving east 2km along the road on the south side is a 100m stretch of folded and contorted limestone referred to as the "Python" (fig 10) by the local Adnyamathanha people. This secondary later local scale folding on the limb of the syncline and has smaller tighter synclines and anticlines within it, giving an overall appearance as a sinuous python.

Figure 10

Figure 11

The eastern end of this structure shows a domed shaped anticline with bedding peeling off like onion skin (fig 11). On one of these surfaces are sets of ripple marks (arrows) indicating a shallow water deposit that had currents that were running in at least two different directions.

Because the limestone behaves in a ductile manner when under tectonic heat and pressure, it folds and buckles in this way, whereas the Nepabunna Siltstone is more brittle and will fracture and crack to form the cleavage pattern seen in the rocks by the Hut.

In conclusion, the Oocaboolina Hut sits almost in the middle of a large syncline and is close to the boundary of the Nepabunna Siltstone and Wilkawillina Limestone. Further to the edge of the syncline and climbing higher is the Parachilna Formation (Sandstones and Siltstones) and the Rawnsley Quartzite, the oldest rocks in this area that forms the rim of hills around the syncline. Being quartzite they are able to resist weathering and erosion and therefore stand out as a ridge of hills. These two outer rock formations were not visited but can be seen from the tops of Wilkawillina Limestone Hills.

The geology in this area represents the very early Cambrian Period when life forms in the seas developed, commonly referred to as the beginning of the Cambrian explosion of life forms, represented here by Archaeocyatha fossils and trace fossils of worm burrow disturbances of the banded bedding layers.

This geological report was developed after a visit to the area by Peter Briggs and Henry Pecanek in September 2024. The interpretations are speculative and open to further discussions.

Friends of the Vulkathunha-Gammon Ranges National Park

References

Satellite photo*: European Space Station,*
https://www.esa.int/ESA_Multimedia/Images/2020/07/Flinders_Ranges_South_Australia

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