

THE DE HOOP FOSSIL SANDBAR:

The De Hoop cottage has been built on a rock platform composed of sandstone that contains structures which record an interesting geological history. It is probably one of the best examples a geologist could hope to find.

A closer look at the rock reveals that it is composed of small grains of sand, between 0,6 and 1,0mm in diameter, that have been cemented together by silica over a very long period of time to form layers of sandstone. These are part of a sequence of rocks the Table Mountain Group, and the sandstone in particular is known as the Peninsula Formation after the type locality around Cape Town. The sand particles comprising the sandstone were deposited in broad shallow rivers about 450 million years ago and became cemented during deep burial at elevated temperature and pressure.

The interpretation concerning the deposition of the sandstone is based on the resemblance between so-called bedforms preserved in the rock and similar features one can observe in present-day sandy streams like the Olifantsriver, which flows alongside the N7 motorway near Citrusdal. These bedforms are called ripples, dunes and bars.

Bars are large tabular bodies of sand that form just below water levels and fill channels. Sand grains are moved along the top surface of the bar in the form of ripples, in shallow swiftly flowing water. When reaching the edge of the bar, where the water deepens, the velocity decreases and sandy ripples avalanche in turn down the inclined leading edge of the bedform. As each ripple avalanches off the edge of the bar, it produces an inclined layer of sand referred to as a foreset. After sufficient repeated deposition events, the end result is a tabular sheet of sand that is internally cross-bedded with planar foresets that slope at about 5 degrees in the direction of flow (Figure 1). Preserved foresets therefore indicate the direction of growth, usually downstream but sometimes laterally, of the bar, and can be used to reconstruct the pattern and direction of flow of the associated river channels as illustrated in Figure 2. The thickness of the tabular planar cross-bedded unit is also a useful measure because it indicates the depth of the channel that was filled and thereby adds a vertical scale to the reconstruction.

Simultaneous with the construction of bars, deeper channelways along the flanks of such bars contain sinuous crested dunes which are simply large ripples. Internally, they are also cross-bedded as a result of avalanching sand grains, but in this instance the foreset planes are curved

through-shaped surfaces (Figure 3). Three-dimensional diagrams of planar and trough cross-bedded bedforms (Figure 1 and 3) illustrate characteristics of the foreset geometry that distinguishes one type from the other. Note the plan view of foreset planes in particular because they are either linear, perpendicular to flow, in the case of bars, or crescent shaped with horns pointing downstream, in the case of dunes.

The reader is now ready to appreciate the fossilized bars and dunes in sandstone preserved around De Hoop. Figure 4 is a photograph taken showing the southern side of the cottage where the foundation rests on a fossil bar denoted as "P". Alongside the left margin of the bar is part of a dune denoted as "T". Notice the linear foreset planes that mark the progressive leading edges of the bar as it developed compared to the curved foreset planes of the dune. The current flow would have been away from the viewer towards west.

The photograph taken from the northern side of the cottage, in Figure 5, illustrates the right hand margin of the bar (P) with numerous dunes (T) preserved alongside. All this evidence is combined in Figure 6 which represents a plan surrounding the cottage. The remnant of the fossil bar is outlined and an arrow towards 255 degrees True North indicated the stream direction that prevailed during deposition. At the northeastern end of the bar, a section through the bar exposes its internal planar cross-bedded structure. The crescent shape foresets of fossil dunes that surround the bar indicates, from their azimuths which range between 230 to 300degrees True North. That sinuous channels must have wound their way around the bar in various directions, generally encompassing the direction indicated by the bar front.

In the small rocky hills on the northern flanks of the property, one can see sections through bedforms similar to those already described, indicating that the environment reconstructed from bedforms around the cottage would have extended laterally, probably over many hundreds of square kilometers, representing an extensive sandy belt constructed by a multiple braided pattern of wide and shallow channels.