LANDFORMS AND SEDIMENTS OF UMBUM CREEK AND ADJACENT PLAINS, LAKE EYRE BASIN, SOUTH AUSTRALIA.

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The western side of Lake Eyre has to date had little detailed documentation of its landform evolution. A detailed study of the lower reaches of Umbum Creek, its delta and surrounding environments aims to understand the regional and local controls on sediment transport and preservation potential within ephemeral systems. The primary focus of this study is the Umbum Creek downstream of the Umbum Creek crossing (Figure 1), although broader studies on parts of the Neales River and Fan system also play an important role in understanding the Umbum Creek evolution.

Located regionally in a semi-arid and sparsely vegetated environment, the Umbum Creek flows into the western side of Lake Eyre, Northern South Australia. Umbum Creek forms the southern inactive distributary of the Neales Fan ending in a terminal delta/splay complex where it flows into Lake Eyre, at the northern end of Haligan Bay (Figure 1). The catchment area that supplies the Umbum Delta with floodwaters and sediment drains six major tributaries that cover approximately 2,700 km^2 and have their headwaters 90 km west in the Adelaidean Davenport Ranges (Table 1).

Table 1: Vital Statistics of Umbum Creek Catchment

Drain area	2700 km^2
Catchment Size	90 x 50 km, east –west elongated
Number of Major Tributaries	6
Drainage Gradient	600:1

Unlike the Neales, which has a much larger catchment (100s of km long) and greater range of sediment sources, the majority of the Umbum catchment comes from the foothills of the Davenport Ranges. These hills contain uplifted Neoproterozoic (Adelaidean) rocks (spectacular folding can be seen from the air), flanked by Tertiary and Quaternary alluvial fan and proximal fluvial sediments that cover outcrops of Mesozoic rocks (Rogers & Freeman 1996, Williams *et al.* 1975). Grainsize of sediments range from cobbles to silt with the dominant sediment supplies including reworked Aeolian fine- to coarse-grained sands, ferruginised silts and sands (gibber plains), quartzite, dolomite, marine shales (Bulldog Shale), chert, palygorskite, celestite and gypsum.

Local sources of sediment supply into the lower Umbum Creek include the adjacent gibber plains and Aeolian dune systems and the underlying and locally exposed Eyre and Etadunna Formations. On the northern side of Umbum Creek the Neales fan is predominately covered by gibber plains that armour underlying coarse-grained fluvial systems, most likely equivalent to the Warmakidyaboo Beds in the Neales River (Croke *et al.* 1996). These gibber plains are overlain by a mud cemented remnant dune system that were most likely sourced from the deflation of the older fluvial system and then subsequently cemented by turbid flood waters. Due to the semi-arid environment ephemeral streams and sheet wash processes dominate the fluvial systems and adjacent plains. These processes constantly erode and rework both the gibber plain and remnant dune system (Figure 2), with either local interdunal playas storing fine-grained sediments or small ephemeral fluvial channels removing these sediments into the larger fluvial systems (Figure 3) (e.g., Umbum and Neales). Aeolian processes are also constantly reworking sediments with locally strong winds capable of moving sand particles up to the lower coarse-grain sand size. The same sediments and processes occur on the southern side of Umbum Creek with the addition of silicified Eyre Formation fluvial sediments that make up Flint Mount and its off-shooting ridges. These silicified sediments supply a more angular coarse-grained to cobble fraction to the local sediments.

Overall erosional processes dominate the sedimentary environment on the western side of Lake Eyre. The Umbum Creek channel itself is a series of nickpoints into both the underlying Eyre Formation (Umbum Crossing, Figure 5) and Etadunna Formation (Superman's Palace, Figure 6). Coarser-grained sediments are stored within the channel belt on pointbars as avalanche front cross-beds (Figure 7 & 8), up to a metre thick. and within the channel at intersection-points as cross-channel bars. Significantly low amounts of coarse-

grained sediment are actually transported to the Umbum mouth; instead coarse-grained sediments at the mouth and delta are locally sourced from the underlying older coarse-grained fluvial deposits. These deposits are being reworked where the channel bifurcates into chute channels, eroding into the older fluvial deposits with final deposition of the fine-grained sand fraction as splay lobes at the end of each channel. Finer-grained sediments (mud and silts) are carried out onto the lake floor as suspended load in floodwaters and then deposited. Finer-grained sands are later transported out onto the lakebed by Aeolian processes during dryer periods and intermix with the muds and silts to form parallel laminations (Figure 9).

Further and continuing work includes subsurface investigations via drilling and coring and Ground Penetrating Radar (GPR) at select sites, dating of the older Aeolian and fluvial systems (OSL and TL dating), petrographic and grainsize analysis of modern sediments around the delta mouth and channel, facies mapping of the delta front (Figure 10), detailed digital elevation model, and vegetation mapping of select species to ascertain relative flood heights during the last 100 years.

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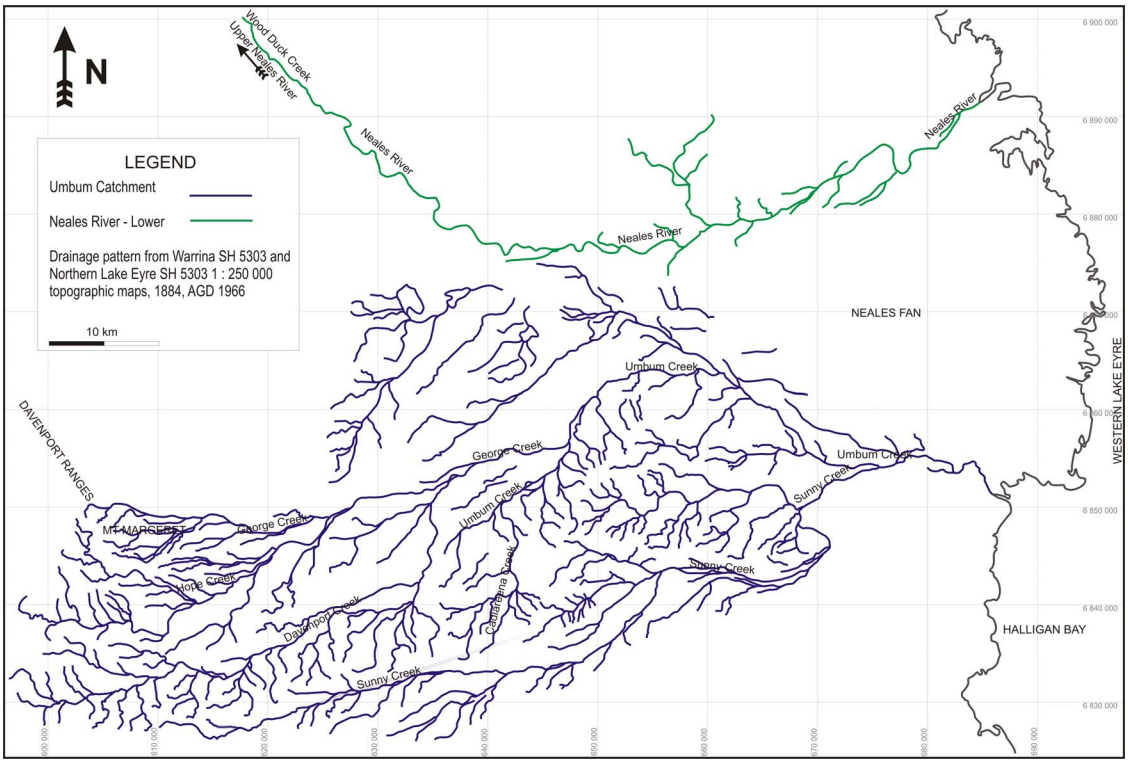

Figure 1: Catchment of the Umbum Creek drains six major tributaries and stretches 90 km west to the foothills of the Davenport Ranges.

Figure 2: Rilled erosion of remnant dune by water and reworked Aeolian sediments in left foreground.

Figure 3: Small fluvial channel incising and eroding into gibber plain adjacent to the main channel.

Figure 4: Remnant Aeolian dune crosscut showing air escape structures (pale sands) in an otherwise mud-cemented dune. Mud cement most likely due to turbid floodwaters infiltrating dune under hydrostatic pressure.

Figure 5: Looking upstream of the Umbum Crossing floodwaters dam against outcrop of Eyre Formation. The outcrop provides a more erosionally resistant substrate in the creek bed and forms a nick point in the fluvial profile.

Figure 6: Superman's Palace, an informal name for this site where the top of the Etadunna Formation outcrops in the base of the Umbum Creek channel, forming an erosionally-resistant substrate and the next nick-point downstream of the Umbum Crossing. gypsum crystals of up to several metres across, celestite and palygorskite all outcrop and the assemblage of mineral is indicative of a drying-up, sulphate-rich, alkaline lake.

Figure 7: > 1 m high avalanche front cross-stratified simple barforms exit the end of chute channels that cut across points bars during elevated flood levels.

Figure 8: Internal bedding of avalanche front cross-stratified beds.

Figure 9: Parallel laminations of mud, silt and fine-grained sands on the delta front.

Figure 10: Aerial photo of the Umbum Delta.