**GONE BUT NOT FORGOTTEN-THE AEOLIAN MODIFICATION OF FLUVIAL SURFACES ON MARS: PRELIMINARY RESULTS FROM CENTRAL AUSTRALIA.** M. C. BOURKE, School of Geography and the Environment, University of Oxford, Oxford, OX1 3TB, UK. Mary.bourke@geog.ox.ac.uk.

**Introduction:** MOC images indicate that aeolian ridges may mask and even obliterate primary depositional surfaces on Mars. This modification increases the difficulty in mapping the recent geological history of the planet. An analogue study in central Australia demonstrates how patterns in aeolian dunes, formed over abandoned fluvial surfaces, can be used to detect buried fluvial features.

**The Analogue Sites:** The study areas are located in the north-western Simpson Desert in central Australia at abandoned paleoflood floodouts and expansion bar complexes. Three catchments have been selected for analysis; the Hale, Palmer and Todd Rivers. Satellite images (TM, 30 m/pixel) were used to identify locations where aeolian dunes (linear and parabolic) modify fluvial surfaces. Following field assessments, four type-sites were selected (two on the Hale, one on the Todd and one on the Palmer River). Collectively these four sites cover the spectrum of modification that occurs in this region.

Specific site factors such as sediment supply, grain size and grain morphology, boundary layer roughness, fluvial topography, frequency of inundation and absolute age of the fluvial surface differ between the four sites. The aim of this project is to isolate the dominant controls on dune form, spacing and texture for abandoned fluvial surfaces. In this way linkages between the dunes and underlying fluvial surfaces can be understood and modeled. These models will then be applied to Martian surfaces where it is hoped that dune properties can be used as geomorphic signatures of buried and modified fluvial surfaces.

**Preliminary Results:** The spacing and size of dunes on the paleoflood surface are significantly different from the regional dune field. The 'new' dunes on the surface of the flood deposit are smaller and more closely spaced than those in the surrounding dune field (Figure 1 and Table 1). Dune dimensions (incl. spacing, height, area), measured along a series of 500-800m transects are approximately 50% of the regional dunes. The change in dune properties occurs abruptly (over a ~100 m distance) and coincides with the boundary of the buried fluvial surface. This indicates that patterns in dune spacing can be used to map the extent of the underlying fluvial surfaces in central Australia and therefore potentially on Mars.

A scanning electron microscope analysis of fluvial and aeolian sediments (50-200 _m) was used to determine the principal provenance of the aeolian grains. The grain morphology of aeolian sediments closely matches that of the flood deposits. This suggests that the principal source of sediment for the dunes is the underlying fluvial deposit and not the regional dune field. In addition, the mean grain size of the dunes is finer than values for the regional dune field, most likely due to accessing suspended load facies.

Samples are currently being analysed by optical luminescence techniques to determine, 1) The lag time between fluvial deposition and the initiation of aeolian modification. 2) The rate at which the dunes have aggraded and 3) To determine how long they have been stable. At the time of writing, preliminary data suggests that the dunes are stable as they have not moved or grown significantly in the last 1,500 years.

**The Potential for Mars:** The spacing of aeolian ridges in valleys on Mars displays large-scale variability. However, small-scale variability in spacing, chord length and ridge form may provide information on the underlying surface.

Figure 2 illustrates the way in which aeolian ridges adjust to valley floor topography. The valley floor appears to have an inner channel. There is a change in the aeolian ridges where they cross the inner channel boundary. 1. Aeolian ridge length increases significantly outside the inner channel. This suggests a confining threshold exerted by inner channels on dune chord length. 2. The dune form changes from transverse (linear) to transverse (barchanoid). This may reflect a differing wind speed and boundary roughness or be the influence of a change in sediment supply from the valley floor. In this example the pattern and form of the dune appears to change as the underlying fluvial topography changes.

These preliminary observations from Mars indicate firstly, that aeolian forms on Mars (similar to Earth) may be sensitive to sub-surface (fluvial) topographic variability. Changes in the pattern, spacing and form of ripples and dunes on Mars may be used to indicate characteristics of the underlying (fluvial) surface.

Secondly, aeolian ridge patterns may be useful high resolution mapping tools. Changes in aeolian ridge patterns are often the only indication of subtle topography change such as inner channels, distributary patterns and mid channel rises/bars. In this way the aeolian bed forms do not mask the fluvial feature, rather they enhance them and improve our ability to accurately identify and map fluvial features at MOC resolution.

**Conclusion:** Recent results from an analogue site in central Australia indicate that the morphological and sedimentological properties of aeolian dunes overlying abandoned fluvial surfaces differ significantly from those of the regional dune field. Attributes of the modifying dunes are key geomorphic signatures of buried fluvial surfaces. These geomorphic attributes are detectable on satellite images. This suggests that the physical attributes of dunes and ripples on Mars may also be used to indicate the presence of heavily modified and buried fluvial surfaces.

**Acknowledgments:** This work is supported by NASA MDAP- 613386

| **Attribute (average)** | **Regional dunes** | **New dunes** | **New dunes as % of Regional dunes** |
|---|---|---|---|
| Height (m) | 15 | 7.4 | 49 |
| Width (m) | 175 | 89 | 51 |
| Wavelength (m) | 315 | 139 | 44 |
| Cross sectional area ($m^2$) | 2,500 | 1414 | 56.5 |

**Table 1.** Field measurement of regional and new Dunes

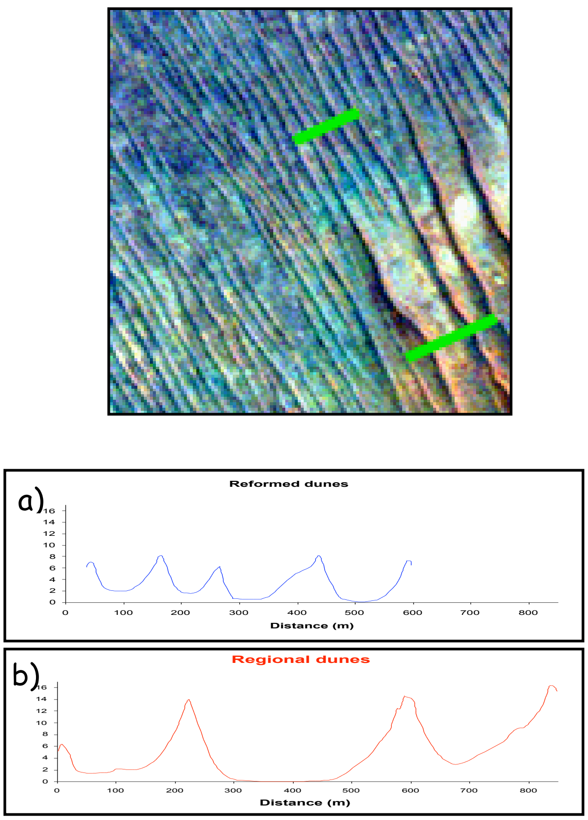


**Figure 1**. Surveyed profile of dunes in NW Simpson Desert on the Todd River floodout. Satellite image above shows location of measured transects a and b. Satellite image is enhanced Thematic Mapper (pixel resolution of 30 m).
a) New dunes. Location is at top of image,
b) Region dunes. Location is at bottom of image.

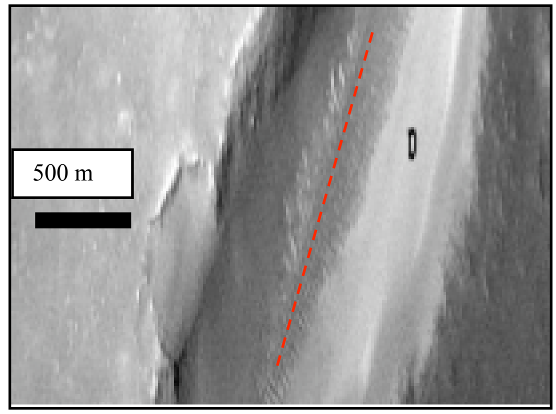


**Figure 2.** Arnus Vallis located in Syrtis Major. The dotted line indicates the location of the inner channel. The transverse aeolian ridges change their configuration as they cross the inner channel boundary. MOC image (M0307414) 13.97° N, 289.97° W 2.95 m/pixel.