

Remote methods for detection of hydrothermal activity in Mars Analogue regions, an example from the Mt. Painter Inlier, northern Flinders Ranges, South Australia

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The mapping of large scale hydrothermal systems presents difficulties of scale and scope to the individual researcher on the ground. In a Martian environment, the scientist on the ground will be guided by an extensive array of remote datasets currently being collected by such instruments as the Thermal Emission Spectrometer (MGS-TES) (Christensen *et al.*, 1992) and Gamma Ray Spectrometer (MO-GRS) (Boynton *et al.*, 1992). Future missions will involve hyperspectral VNIR spectrometry (CRISM) (Murchie *et al.*, 2003). Experience in applying these types of remote datasets to Earth bound problems will assist the future Martian explorers by formulating techniques and best practices to capitalize on the strengths of each particular dataset type.

During Expedition II, a variety of remote mapping techniques will be brought to bear on resolving the problem of mapping hydrothermal alteration in the Mt. Painter district near Arkaroola. Remote mapping of alteration mineralogy will be compared with established geological mapping (Coats and Blissett, 1971; Drexel, 1980; Jago and Moore, 1990; Drexel *et al.*, 1993; Preiss, 2000) to place the hydrothermal events in a geological context and timeframe. Attempts will be made to identify relationships with stromatolite horizons (Preiss, 1973) in the area, in order to understand whether they are related to palaeo-hydrothermal sites.

This report details the background research that has been conducted in preparation for field mapping. Reduction of ASTER, LANDSAT and HyMap datasets will be reported, and sites for further investigation will be highlighted.

References

- Boynton, W. V., Trombka, J. I., Feldman, W. C., Arnold, J. R., Englert, P. A. J., Metzger, A. E., Reedy, R. C., Squyres, S. W., Wanke, H., Bailey, S. H., Bruckner, J., Callas, J. L., Drake, D. M., Duke, P., Evans, L. G., Haines, E. L., McCloskey, F. C., Mills, H., Shinohara, C. and Starr, R. (1992) Science Applications of the Mars-Observer Gamma-Ray Spectrometer. *Journal of Geophysical Research-Planets*, 97 (E5), 7681-7698.
- Christensen, P. R., Anderson, D. L., Chase, S. C., Clark, R. N., Kieffer, H. H., Malin, M. C., Pearl, J. C., Carpenter, J., Bandiera, N., Brown, F. G. and Silverman, S. (1992) Thermal Emission Spectrometer Experiment - Mars-Observer Mission. *Journal of Geophysical Research-Planets*, 97 (E5), 7719-7734.
- Coats, R. P. and Blissett, A. H. (1971) Regional and economic geology of the Mount Painter province, in *South Australia Geological Survey Bulletin 43*, pp. 426, Adelaide, SA.
- Drexel, J. F. (1980) Geology of a portion of the southern Mount Painter Inlier, in *Report Book Number 80/102*, pp. 62, Department of Mines and Energy, Mineral Resources Section, Adelaide, SA.
- Drexel, J. F., Preiss, W. V. and Parker, A. J. (1993) The Geology of South Australia. Vol. 1, The Precambrian, in *South Australia Geological Survey Bulletin 54*, Department of Mines and Energy, Mineral Resources Section, Adelaide, SA.
- Jago, J. B. and Moore, P. S. (1990) The Evolution of a Late Precambrian-Early Palaeozoic Rift Complex: The Adelaide Geosyncline, in *Geological Society of Australia Special Publication 16*.
- Murchie, S., Arvidson, R., Beisser, K., Bibring, J.-P., Bishop, J., Boldt, J., Bussey, B., Choo, T., Clancy, R. T., Darlington, E. H., Des Marais, D., Fasold, M., Fort, D. E., Green, R. O., Guinness, E. A., Hayes, J., Heyler, G., Humm, D., Lee, R., Lees, J., Lohr, D., Malaret, E., Morris, R. L., Mustard, J., Rhodes, E., Robinson, M., Roush, T., Schaefer, E., Seagrave, G., Silverglate, P., Smith, M. D., Strohbehn, K., Thompson, P. and Tossman, B. (2003) CRISM: Compact Reconnaissance Imaging Spectrometer for Mars on the Mars Reconnaissance Orbiter, in *Sixth International Conference on Mars*, pp. 3062, LPI, Houston, TX.
- Preiss, W. V. (1973) Palaeoecological interpretations of South Australian Precambrian stromatolites. *Journal of the Geological Society of Australia*, 19, 501-532.
- Preiss, W. V. (2000) The Adelaide Geosyncline of South Australia and its significance in Neoproterozoic continental reconstruction. *Precambrian Research*, 100 (1-3), 21-63.

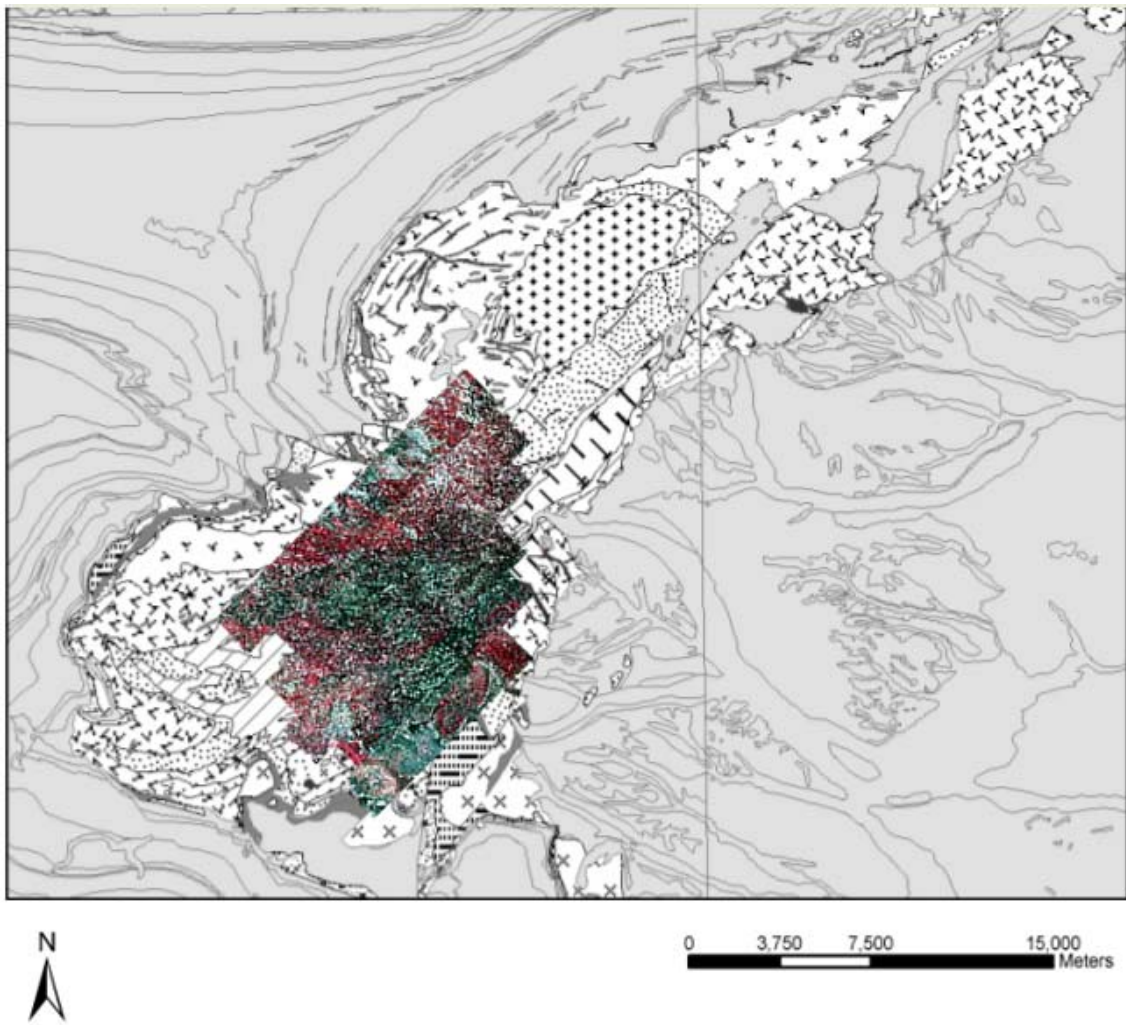


Figure 1 – Hymap data overlain on a geological map of the Mt Painter Inlier.