Regolith and landform mapping

The benefits of radar for mapping landforms and discriminating between regolith materials in deeply weathered terrains are well described by reference to an examination of AIRSAR polarimetric data in the Gawler Craton, South Australia. Findings in the Yilgarn Craton, Western Australia, were similar. Importantly, the fundamental attributes of a deeply weathered terrain, namely erosional and depositional regimes, can be recognized. In this topographically flat, semi-arid terrain, the most distinctive radar responses occur from prominent outcrop and associated debris of Precambrian volcanics [Figure 2, Location 1] and irregular surfaces of dissected silcrete tablelands (Location 2). These contrast strongly with a blanket of alluvial, colluvial and aeolian sediments (Location 3) with a ~10% vegetative cover of chenopod-shrubland communities, which have low-to-medium backscatter. Specific observations include:

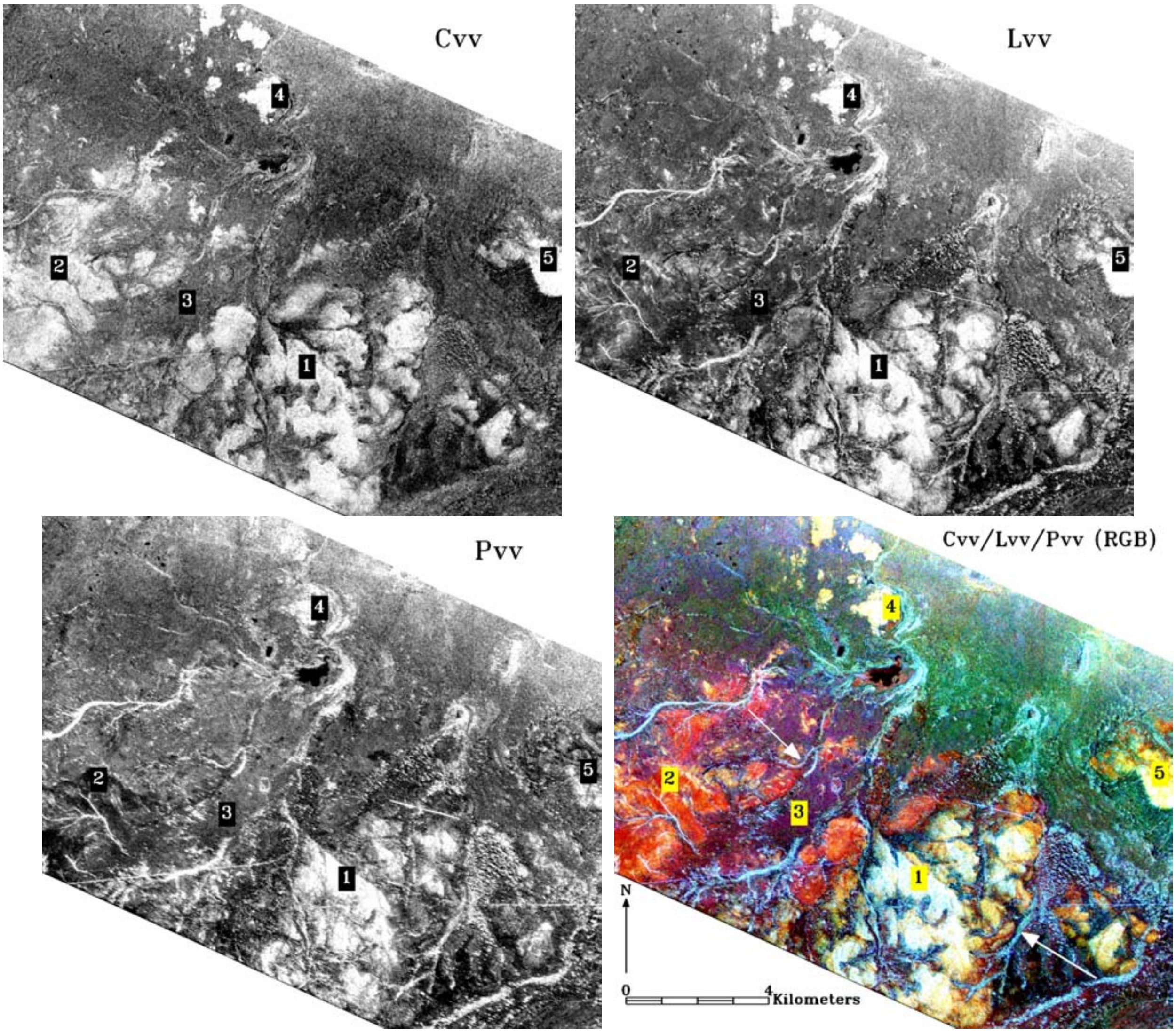

Figure 2: *Variation in vertically polarized radar backscatter with changing surface roughness according to AIRSAR C, L and P band wavelengths, and a composite image of the three wavelengths. A previously unmapped NW-SE aligned linear feature [1] in the composite image is clearly evident in the Pvv band image and, to a lesser extent, in the L and C band images.*

- The mapping of regolith-landform units is primarily a function of multi-frequency rather than multi-polarization, with the greatest sensitivity to roughness being observed in the VV-polarized data for each frequency. Regolith-landform units of the erosional regime can be delineated from those in other regimes by the increased surface roughness resulting from the accumulation of coarser lag gravels and exposure of bedrock during active erosion of the landscape. Outcrops of igneous rocks at Locations 1, 4 and 5 produce the strongest returns in co-polarized signals from all three frequencies and appear as white to bright yellow in the composite image.

- Best discrimination between the landforms developed in erosional terrains is obtained from enhancements of L- and P- band data. C-band data generally do not discriminate between these landforms because their surface materials are “radar rough” at this wavelength. In Figure 2, for example, outcropping rhyodacite at Location 1 in the C-band image are confused with the medium to coarse lags of silcrete gravels and calcrete nodules developed over granite saprolite [Location 2], whereas clear distinction is made in L band. L- and, to a lesser extent, P-band signals highlight the topographic alignments of breakaway slopes that define the extent of these tablelands. Incision of the tableland by ephemeral streams has resulted in exposure and accumulations of massive to nodular calcrete and silcrete gibber that strongly backscatter the radar signals. In addition, in an area of increased dissection at Location 2, L band has clearly delineated a semi-radial pattern of isolated topographic highs of weathered granite overlain by a lag of silcrete gravels and cobbles.
- C band provides clear discrimination between erosional and depositional terrains owing to the relative smoothness, at the scale of the L-and P-band wavelength, of regolith-landforms located in depositional terrains.