

Geologic, geochemical and mineralogic framework for Aeolis Palus bedrock, and its relationship to Mt. Sharp, Mars

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For the past 30 months the Curiosity rover has encountered stratified bedrock along a drive route extending from Bradbury Landing → Yellowknife Bay → Kimberley → Pahrump, a distance of ~9 km. Curiosity still has ~2.5 km to make it to Murray Buttes, taken as the base of Mt. Sharp. All bedrock outcrops expose sedimentary rocks, including mud/silt/sandstones, and conglomerate, all of basaltic composition. These rocks all form part of a fluvio-lacustrine facies association, with small volumes of co-mingled eolian deposits. Most are simply interpreted as distal alluvial fan deposits. Paleocurrent data from the Shaler outcrop (Yellowknife Bay) suggests a dominant component of southwesterly flow, and scattered outcrops within the Kimberley to Zabriskie region provide evidence for southward-prograding clinoforms. Thus, most of the volume of sedimentary rock observed during the drive from Yellowknife Bay to the Kimberley is consistent with derivation of sediments from erosion of the northern crater rim. A major compositional change is observed in the Yellowknife Bay formation where lower members (Sheepbed, Gillespie) are slightly more mafic than average martian crust, whereas the overlying Glenelg member are more depleted in MgO+FeO, and more enriched in K₂O (and Na₂O locally). This signature of elevated K₂O has been observed commonly in outcrops extending all the way to the Kimberley where the drilled Windjana sandstone revealed significant quantities of potassium feldspar. Conglomerates may differ from sandstones in containing a greater fraction of plagioclase feldspar. This suggests that much of the bedrock that underlies Aeolis Palus between Yellowknife Bay and the Kimberley is derived from alkaline source rocks, likely located along the northern rim. In contrast, the lower part of Yellowknife Bay, including the Sheepbed mudstone - with finer grain size - might record more distant provenance. Recent results reflecting the geochemistry and geology between the Kimberley and lower Mt. Sharp rocks will also be discussed.