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Chemistry of Conglomerates analyzed by Curiosity at Gale crater, Mars

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The first conglomerate outcrops encountered by Curiosity were isolated, well-indurated blocks that had pebbles up to 4 cm in diameter [1]. These conglomerates were observed in the immediate vicinity (<200 m) of the landing site and were interpreted as fluvial sediments [1]. Along the >10-km long rover traverse, conglomerates were observed at limited exposures and a few outcrops with well-exposed sections, including two field sites informally named Darwin and Kimberley. Geochemical information regarding the conglomerate exposures was acquired with two instruments: (1) 40 targets were analysed by ChemCam, which analyses 0.5 mm diameter spots on rocks, and (2) 6 targets were analysed by the Alpha X-Ray Spectrometer (APXS), which derives the bulk chemistry over a 1.7 cm diameter spot. The chemistry acquired by ChemCam recognizes two main groups: samples exposed across hummocky plains and at the Darwin outcrop, and a smaller group of conglomerates analysed at the Kimberley site. The small spot size that ChemCam analyses enables derivation of local mineralogy. The analysis of ChemCam data on the first group shows the predominance of plagioclase, with a local presence of alkali feldspars, in agreement with the high Na_2O/K_2O ratio of 5 to 10. The second group at Kimberley are distinct from the first group because they exhibit a much higher K and Fe content and a much lower Na_2O/K_2O ratio (<2). Individual analyses point towards the presence of alkali feldspars, including anorthoclase and sanidine. The comparison of conglomerates with finer-grained sedimentary rocks deposited by fluvial and lacustrine processes [2] is interesting and permits an understanding of the various processes that formed these sediments. While the fine-grained sediments are commonly more basaltic than the conglomerates, these differences suggest modifications by a combination of physical sorting and diagenetic fluids that cemented these rocks. The entire dataset of 40 conglomerate targets displays a significant difference relative to the bulk martian crust, especially higher alkali and aluminium, both with ChemCam and APXS. This observation confirms and extends the conclusion made from float rocks of the

presence of significantly evolved crust-forming igneous parent rocks in the ancient crustal highlands at the Gale impact site [3].

References:

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