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MARTIAN SEDIMENTS AND SEDIMENTARY ROCKS; C.D. Markun, Department of Environmental Regulation, 4520 Lake Fair Blvd, Tampa, FL

Martian sediments and sedimentary rocks, clastic and non-clastic, should represent a high priority target in any future return-sample missions. The discovery of such materials and their subsequent analysis in terrestial laboratories, would greatly increase our understanding of the Martian paleoclimate.

The formation of Martian clastic sedimentary rocks, under either present, low-pressure, xeric conditions or a postulated, high-pressure, hydric environment, depends upon the existence of a supply of particles, various cementing agents and depositional basins. Chemical sediments may have formed in other basins during any previous hydric phase of the Martian paleoclimate.

Viking surface imagery leaves no doubt as to the nature and supply of Martian clastic materials in the planet's post-hydric phase. Clay-boulder size particles seem to be abundantly distributed across the planet's surface. Possible depositional basins,some of which pre-date the change to xeric conditions, include grabens, channels, canyons, etched pits and impact craters. The crucial question, therefore, concerns the presence or abscence, in recent or ancient eras, of cementing agents

Terrestial cements are typically quartzose. Statistically less important cements include calcite and siderite. Cements are usually formed from either aqueous solutions, precipitating cements in the pore spaces of unlithified sediments or by pressure solution at depth. Little is known about the thickness or moisture content of the Martian regolith, though it may be possible, even today, that (a) reactions between frost/fog droplets and Martian Fe-oxides produce small quantities of Fe-oxide cement; (b) reactions between the Ca-plagioclase component of Martian basalts, the droplets and the CO_2-rich atmosphere might produce quantities of calcite in solution; and/or (c) pressure solution reactions may occur at great depth if particularly thick accumulations of sediments occur. Compaction and pressure solution, under lower Martian gravity regimes, would require more time than terrestial analogs.

The chief question here is "where to look?". The lack of any evidence for widespread Martian tectonics virtually eliminates the possibility of locating ancient, deeply buried sedimentary rocks in stratigraphically interpretable sequences. Slump debris and crater ejectas may contain ancient sedimentary rocks, but location and interpretation would be exceedingly difficult. Certain areas, such as Ganges Chasma, the horst flanks of Noctis Labyrinthus, or the valley walls evident in the "etched" and "fretted" terrain may expose very thick stratigraphic sequences, though sampling the steep slopes would present severe engineering problems. A very high resolution(mm-cm range) photographic reconnaissance of these areas would produce a quantum jump in our understanding of Martian geological history. Sampling would be confined to more horizontal(recent) surfaces. Both exploration techniques are suggested for various hypothetical Martian sedimentary rocks in Table 1.

Table 1. Sampling the Martian Sediments

CLASTIC

Type	Ex	Probability	Terrains	Feature	lat.	long.
Conglomerate						
glacial	P	good	Etched		76S	74W
	P	good	Fretted		38N	65W
	P	good	Patterned Pl.		33N	91W
fluvial	S,P	high	Channelled		23N	33W
Breccia	S,P					
fanglomerate	S,P	good	Canyon Walls	Ganges Ch	8S	46W
				Capri Ch	12S	46W
Sandstones						
aeolian	S	v.high	Old cratered		47S	160W
fluvial	S	v.high	Channelled	Chryse P.	23N	33W
			Old cratered		48S	98W
Arkose	P	high	Graben/horst	Cerranius Fossae	24N	97W
Greywackes	-	v.low	-	-	-	-
Shales						
lacustrine	S	low	Channelled	Chryse P.	23N	33W
marine	-	v.low	-	-	-	-
paludal	-	v.low	-	-	-	-
Siltstone(loess)	S	moderate	'polar'		80S	10-90E
					85N	30E-90W

NON-CLASTIC

Type	Ex	Probability	Terrains	Feature	lat.	long.
Limestones & cherts	-	v.low	-	-	-	-
Evaporites	S	low	channelled	Chryse P.	23N	33W

Key: P=Photoreconnaissance Pl.=Plains Ch=Chasma
S=Direct sampling P =Planitia v=very
Probability=Probability of occurrence and detection