P23A-1607

Insights from a Geophysical and Geomorphological Mars Analog Field Study at the Great Kobuk Sand Dunes, Northwestern Alaska

Mcginnis, R. N.[1]*; C. L. Dinwiddie*[1]*; D. Stillman*[2]*; K. Bjella*[3]*; D. M. Hooper*[1]*; R. E. Grimm*[2]

1. Geosciences and Engineering Division, Southwest Research Institute, San Antonio, TX, United States.
2. Space Science and Engineering Division, Southwest Research Institute, Boulder, CO, United States.
3. Cold Regions Research and Engineering Laboratory, U.S. Army Corps of Engineers, Fairbanks, AK, United States.

Terrestrial dune systems are used as natural analogs to improve understanding of the processes by which planetary dunes form and evolve. Selected terrestrial analogs are often warm-climate dune fields devoid of frozen volatiles, but cold-climate dunes offer a better analog for polar dunes on Mars. The cold-climate Great Kobuk Sand Dunes (GKSD) of Kobuk Valley National Park, Alaska, are a high-latitude, slowly migrating analog for polar, inter- and intracrater dune fields on Mars.

The 67°N latitude, 62 km^2 GKSD consist of moderately well sorted, fine-grained sands deposited within the Kobuk River valley ~50 km north of the Arctic Circle and ~160 km inland from Kotzebue Sound. Winds at the GKSD are influenced significantly by complex surrounding topography, an influence that is similar to many high-latitude inter- and intracrater dune fields on Mars. Average annual temperature and precipitation at the GKSD are –5°C and 430 mm. The dune field is generally resistant to atmospheric forcing (wind) for a significant portion of the year because of snowcover, similar to the effect that seasonal CO_2 and H_2O frost mantling have on Martian polar dunes. The dune field, which ranges in elevation from 33 to 170 m above mean sea level, consists of sand sheets as well as climbing and reversing barchanoid, transverse, longitudinal, and star dunes. Several tributaries to the Kobuk River bound and dissect the GKSD, producing cutbank exposures and alcoves that reveal internal structure.

We report results from our detailed geophysical and geomorphological site characterization field study, which was conducted near peak freeze conditions from March 15 through April 2, 2010. We used multifrequency ground-penetrating radar (25, 50, 100, 250, 500, 1000 MHz) and capacitively coupled resistivity methods to image the internal structure of representative dunes, and performed ground truthing using a sampling auger, natural exposures, and Real-Time Kinematic Differential GPS. Data from twenty system-wide geophysical surveys and ten boreholes revealed the presence of a shallow water table throughout the active portion of the GKSD. The distinctive water table radar signature was that of a reflector that closely parallels topography and cuts across steeply dipping bedforms. The water table is slightly nearer the surface within interdunes than it is below dune crests. The presence of water did not inhibit signal penetration; features were recognizable at two-way travel times of 560 to 1100 ns using 25, 50, and 100 MHz antennas. Our results suggest the dune field may serve as a

localized recharge zone, with volatiles emplaced through both snowfall and rainfall, although a supra-permafrost talik cannot yet be ruled out. We interpret the available evidence to suggest that longlived snowcover combined with a shallow aqueous reservoir is primarily responsible for the low migration rate of this dune system (1.3 m per year).

Mcginnis, R.N., C.L. Dinwiddie, **D.E. Stillman**, K. Bjella, D.M. Hooper, and R.E. Grimm, 2010, Insights from a Geophysical and Geomorphological Mars Analog Field Study at the Great Kobuk Sand Dunes, Northwestern Alaska, Eos Trans. AGU, 91(52), Fall Meet. Suppl., Abstract P23A-1607.