DUNE WIDTH AND SPACING IN TITAN'S BELET SAND SEA IN RELATION TO TOPOGRAPHY HIGHLIGHTS POTENTIAL SEDIMENT TRANSPORT PATTERNS. B. Bishop[1], R.C. Lewis[1], J. Radebaugh[1], E. H. Christiansen[1]. [1]Brigham Young University, Department of Geological Sciences, Provo, UT 84602, b.radleybish87@gmail.com, corbinlewis13@gmail.com.

Introduction: Eolian dune fields found within Titan's equatorial region between ±30° latitude cover approximately 15-17% of the moon's surface [1,2]. These dominantly linear dunes are similar in form, size, and radar reflectivity to the large dunes of the Namib, Saharan, Saudi Arabian, and Australian deserts [3, 4]. Terrestrial dune patterns and their variation in width and spacing are the surface expression of the inputs (sediment supply and wind velocities) controlling the dune's formation and dynamics [5]. This holds true on a larger scale to help explain the accumulation of dunes into sand seas. Data gathered in the Namib Sand Sea suggest that small dunes are located in areas where sand transport rates are high and large dunes where transport rates are low [5,6]. In the Namib, the greatest dune width, and additionally sediment accumulation, are located near the center of the dune field, where sand transport rates are relatively low [6]. Wind velocities typically decrease as a result of converging transport pathways associated with major or minor topographic obstacles, or areas of low elevation [6]. Applying these conclusions to analyses of linear dune patterns on Titan may elucidate surface-atmosphere interactions, to ultimately discover potential sediment transport patterns [7, 9, 8, 10, 11].

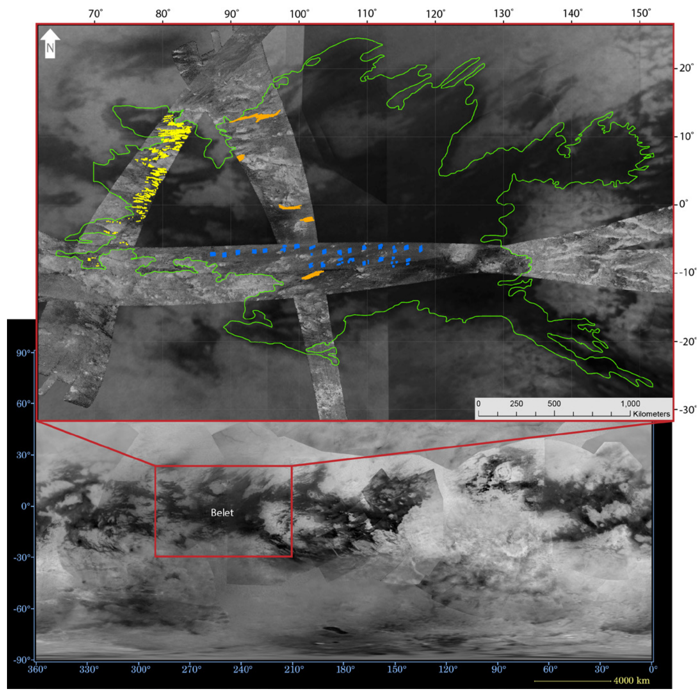

Fig. 1 (A) Image of the Belet Sand Sea showing its equatorial position on Titan's trailing hemisphere. (B) Map illustrates the estimated maximum extent of Belet in green [2]. *Locations of dune width and spacing measurements are shown on Cassini SAR swaths T08 (blue), 28 Oct, 2005, T21 (yellow), 12 Dec, 2006, T49 (orange), 21 Dec, 2008, T61, 5 Aug, 2009. Orange represents new dune width/spacing data. Yellow data acquired from [8]. Blue data acquired from [12, 13].*

Approach: Within Titan's dune fields, initial studies of dune parameters utilizing a broad, global approach have shown that dunes are generally wider at low latitudes (with an inflection point at 7° S) [2, 4, 8, 12, 13] However, the evolution of dune width and spacing as material is transported in the migration direction (west to east) through a given sand sea system is not as well understood on Titan [13]. Likewise, the relationship between dune width and spacing with regional basin topography is not well constrained. Using data gathered from Cassini's Synthetic Aperture Radar (SAR), we analyzed the morphometric variation in dunes across one of Titan's major sand seas, Belet.

The Belet Sand Sea is located on Titan's trailing hemisphere between -30° and 25° latitude and 65° and 150° W longitude (Fig. 1). [4] and [2] describe Belet as the largest sand sea on Titan with an estimated area of 3.3 ± 0.6 million km^2 and a sand volume of 610,000-1,270,000 km^3, double the size of the combined Arabian sand seas on Earth. Compared to other Titan sand seas, the dune forms in Belet are tightly spaced, exceptionally straight and long and have SAR-dark, sand-rich interdunes in the center of the sand sea [14, 3, 4].

Using a new method developed in ArcMap 10.3 we produced approximately 8,800 new width and spacing measurements across swath T49 (orange in Fig.

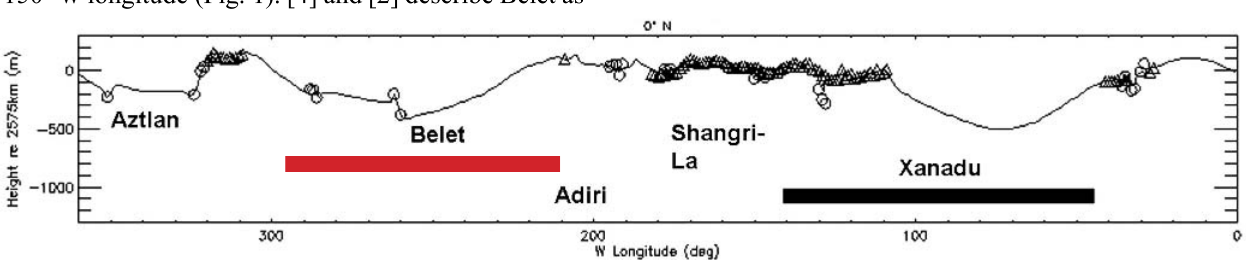

Fig. 2 Profile of interpolated surface height along 0° latitude. Red bar shows approximate extent of Belet Sand Sea. Circles represent SARtopo measurements and triangles indicate altimetry measurements [15]. *The west dipping slope through Belet may help to explain the unexpected correlation between dune width and spacing with longitude.*

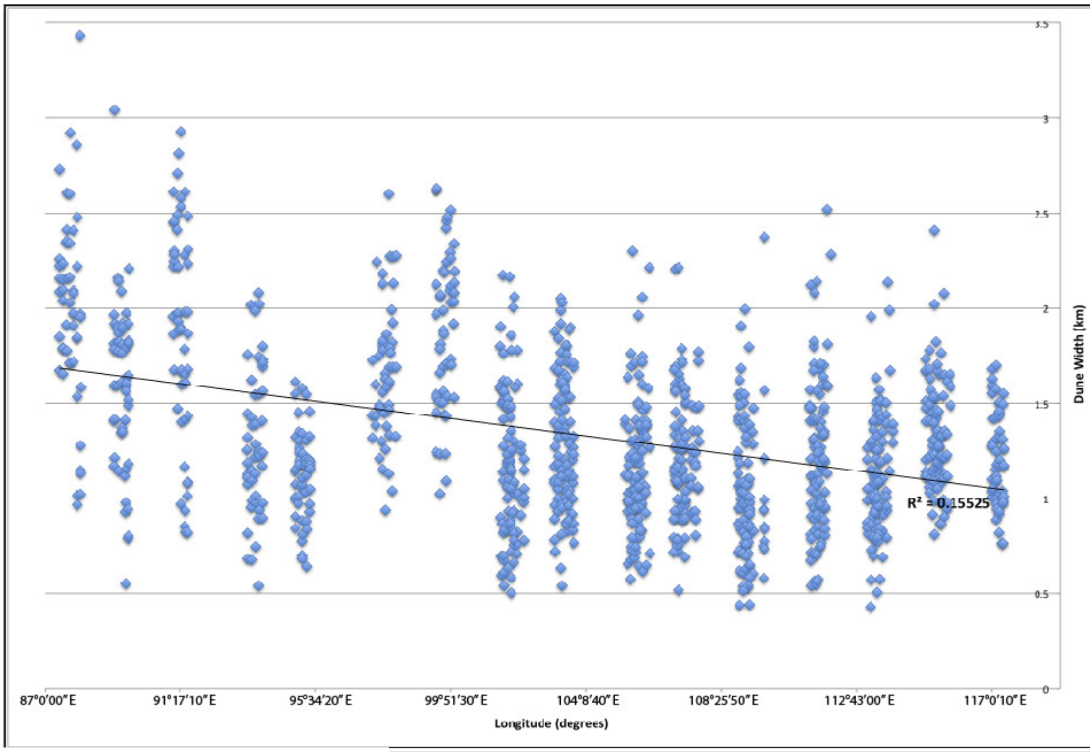

Fig. 3 Dune Width vs. Longitude in Swath T08 in Belet. *Dune widths were measured in NS bands spaced about 500 km apart and having areas of 90 km². An overall trend of decreasing dune width from west to east is apparent. Regional topography perhaps more tightly constrains dune width than distance from the upwind margin.*

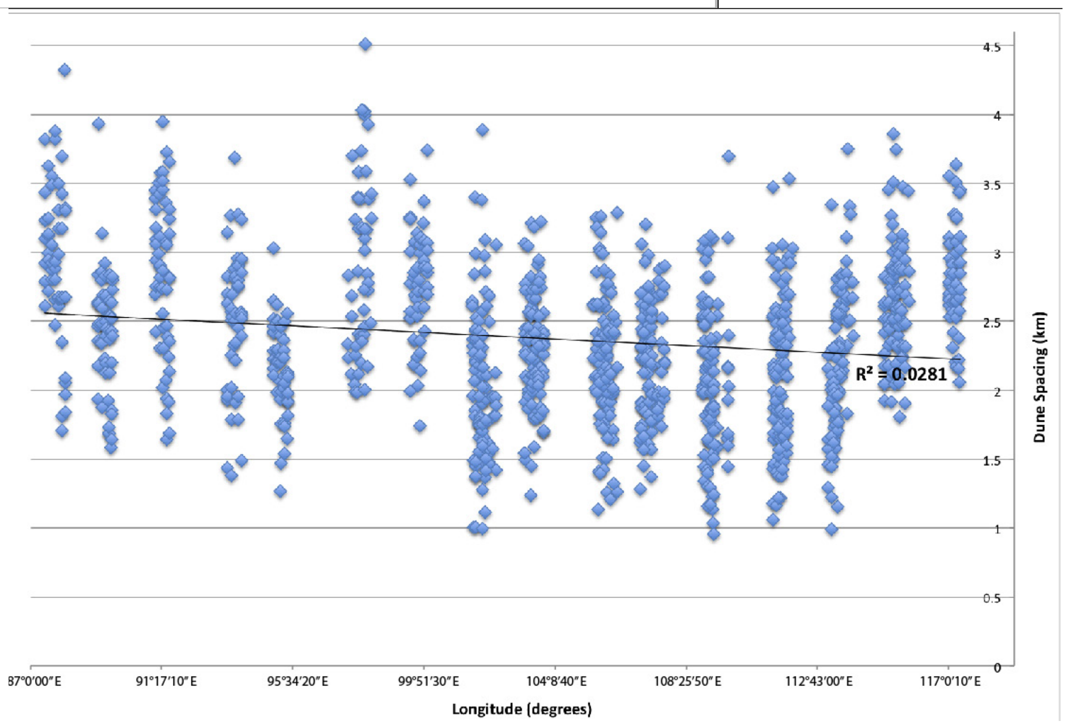

Fig. 4 Dune Spacing vs. Longitude in Swath T08 in Belet. *A weak overall trend of decreasing dune spacing from west to east is apparent. Measurements taken in 90 km² intervals explains the quantization of data.*

1) which stretches approximately across the sea. We incorporated these new measurements with previously collected data across T21 and T8 in our analysis. The global topographic map assembled by [15] allowed us to investigate the effect of east-west variations in elevation across Belet (Fig 2.).

Results and Discussion: Results gathered from swath T49 (orange in Fig. 1) suggest that dune widths are smallest at approximately 13° N latitude and greatest at approximately 3° S latitude. This bolsters the previously established correlation between dune width with latitude [2, 4, 8]. Dune width and spacing measurements shown in Fig. 1 as blue are represented in scatterplots in Fig. 3 and Fig. 4. The correlation between width and longitude is stronger than that of spacing and longitude, but both dune width and spacing correlate somewhat with longitude and decrease to the east. However, an opposite trend for dune width might be expected where sand transport is from west to east; dune width and spacing typically increase in the migration direction, where dunes originate at the upwind margin of a field [16]. In Belet, the westward dipping regional slope may have a strong effect on the dunal spatial trends.

Conclusions: New analyses of dune widths in the Belet Sand Sea corroborate the global correlation between decreasing dune width and latitude. Additionally, we find that dune width and spacing decrease in the migration direction to the east. The westward dipping regional slope of Belet's surface may help to explain this morphometric trend, in which the size and shape of the topographic basin helps to constrain dune size. More analyses of dune parameters with location in the sand sea, distance from margins, and proximity to obstacles will yield tighter controls on sediment transport patterns on Titan's surface.

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