CHARACTERIZATION OF LIGEIA MARE IN THE NORTH POLAR REGION OF TITAN. F. Wasiak[1], D. Androes[1], D. G. Blackburn[1,2], V. Chevrier[1], J. Dixon[1]. [1]Arkansas Center for Space and Planetary Sciences, 202 FELD, University of Arkansas, Fayetteville, AR 72701, USA, fwasiak@uark.edu. [2]NASA Postdoctoral Fellow, Jet Propulsion Laboratory, California Institute of Technology, 4800 Oak Grove Drive, Pasadena, CA 91109, USA.

Introduction: Ligeia Mare, the second largest sea on Titan, resides in an area dominated by seas in the northeastern polar region. The mare is in a large endorheic drainage basin with shoreline morphology similar to terrestrial man-made reservoirs where water is dammed and valleys are flooded. Here we describe the mare and surrounding geologically diverse terrain, to include observations indicating active processes evidenced by broad incised valleys, hummocky and mountainous regions, varied fluvial drainage patterns, eroded rugged terrains, and rivers emptying into the sea. Headward erosion has carved valley and ridge systems in the flanks of more distal highlands, while broad highlands, uncut by rivers or extensive erosion, contain smaller lakes and lakebeds, and vast mottled plains. Near shore submerged channels surround the mare, suggesting lower liquid levels in the past.

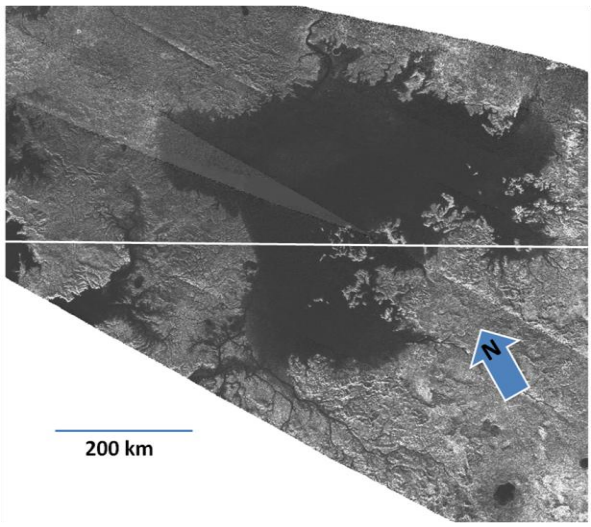

Figure 1: Polarsteriographic composite from Cassini SAR swaths T25, T28, and T29 (22 Feb 2007, 10 April 2007, and 26 April 2007 respectively). White stripe indicates altimetry profile estimate path for figure 4 [1,2].

Characterization: Fluvial incision into bedrock (water ice) is likely to be similar to that on Earth for similar conditions of slope, discharge, and sediment supply [3]. Channel flow directions into Ligeia are predominately northwesterly with headwaters originating in the highlands to the south. Lesser flow contributions are afforded from the north. Figure 2 indicates channel flow into Ligeia Mare based on main channel surface area (km^2) and direction of flow.

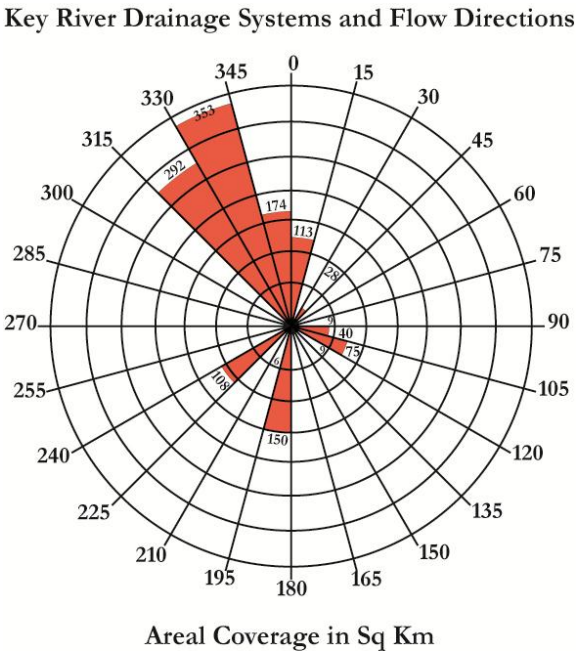

Figure 2: Rose diagram demonstrating a northwesterly flow direction dominates across the southern portions of the Ligeia Mare watershed; a southwesterly flow direction dominates in the North.

Figure 3 shows a submerged channel within a flooded valley suggestive of lower liquid levels in the past.

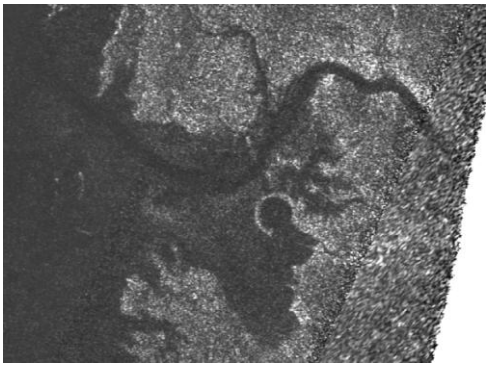

Figure 3: Submerged channel and craterform with central peak (240 W, 83 N).

A structure indicative of an impact crater features a circular bright rim rising out of the dark liquid with an apparent central peak. The crater is in close proximity to a major river, although little alteration has resulted. The crater rim is intact with the exception of the eastern edge having suffered from erosion, flow melt, or other degradations.

The area south of Ligeia is a mottled terrain superimposed with lakes and dry lake beds. The filled lakes are predominately clustered in what appears to be a modest depression [1,2] in the south-eastern region, while dry lake beds predominate to the west (Figure 4).

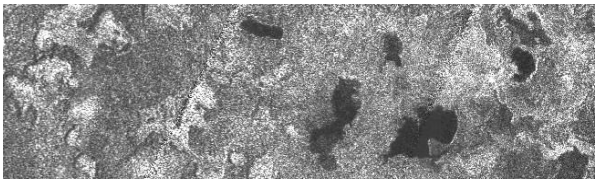

Figure 4: Highlands south of Ligeia Mare with full and empty lakes (70 N, 230W).

A dome situated west of Ligeia Mare is ~150 km in diameter with an altitude ~1500 m above sea level [1,2], and separates Ligeia from Kraken Mare in this region. The dome appears to exhibit annular drainage, becoming more dendritic downwards towards Ligeia. Terrestrial analogs exhibiting such annular drainage evolve in breached or dissected domes (Figure 5.)

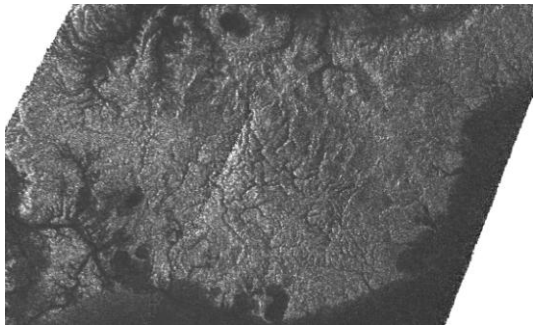

Figure 5: Uplifted dome 1500 m above sea level (270 W, 77 N).

Discussion: The combined erosive and transport capacities of rivers, along with topographic relief of hundreds of meters, suggests that large quantities of sediment have been exhumed and deposited into Ligeia. By measuring resolvable river valley areas through the use of geographic information systems (GIS), and assuming an average depth of 50 m for main channels, and 20 m for tributaries, sediment accumulation volumes through time have been estimated (Table 1). Extensive fluvial features beyond Cassini's SAR resolution of ~350 m to ~2 km are probable, noting the Huygens probe detected fluvial features during its decent that are not detectable using Cassini's SAR.

Direction of Flow	Sediment Volume (10^9 m^3)	Valley Area (km^2)
NE: 0-90	8.2	175
SE: 90-180	6.2	124
SW: 180-270	13.3	268
NW: 270-360	49.7	1255

Table 1: Estimated river valley areas and sediment volumes assuming an average depth of 50 m for main channels, and 20 m for tributaries.

The topography surrounding Ligeia varies significantly as indicated in Figure 6 [1,2].

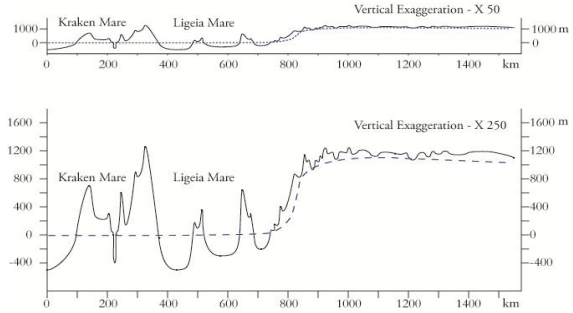

Figure 6: Estimated altimetry along the white stripe shown in Figure 1. Dotted line indicates liquid level. White stripe in Figure 1 begins in Kraken Mare (0 km), across highlands and into an estuary of Kraken (225 km), over a steep uplifted dome, into Ligeia Mare, across an island (500 km), across a peninsula (650 km), and into the highlands (800 km). Liquid depths are inferred and likely much deeper through the center.

References: [1] Stiles et al. (2009) *Icarus*, 202 (2) (8): 584-98. [2] Stiles et al. (2011) Personal email. [3] Collins (2005) *Geophysical Research Letters* 32 : L22202.