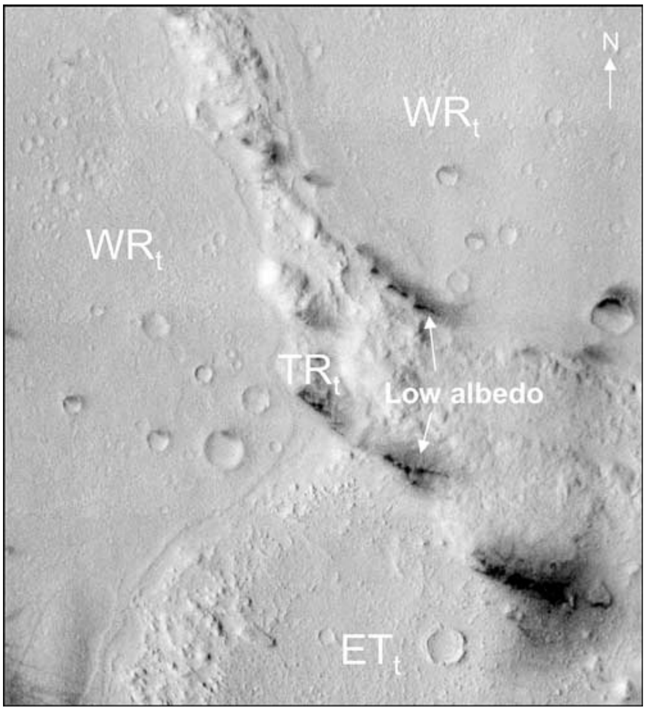

Figure 7. THEMIS visible image (V01580003) showing TR_t, associated low-albedo areas, and the contact between TR_t, WR_t, and ET_t units.

Thermophysical properties of TR_t are comparable to the PL_t, ET_t, and WR_t units, however, TR_t can still be distinguished from these units. TR_t lacks cold and warm craters present in WR_t and ET_t respectively. It also lacks the mottled surface common to ET_t.

3.3. Morphological Characteristics

3.3.1. Unit Descriptions

[24] An independent assessment of THEMIS and MOC visible images was used to identify *morphologic units* on the basis of distinguishing morphologic characteristics (Table 1). As applied here, a morphologic unit is defined as a laterally extensive unit with a homogeneous surface texture that occurs within a specific range of elevations. Seven distinct morphologic units were identified (Figure 4b), many corresponding to previously identified thermophysical units (Figure 4a).

[25] MV_m (Figure 8a) can be identified in Ma'adim Vallis on the basis of the presence of subdued ridges parallel to longitudinal axis of the valley. This morphological expression, however, does not appear to extend into Gusev Crater. In fact, the area within Gusev that was previously defined (thermophysically) as MV_t has surface textures very similar to PL_m. Despite this, an escarpment, corresponding to the suggested thermophysical boundary for MV_t extends from Ma'adim into Gusev and to the east of a small crater (Figure 9a). This suggests that MV_m may extend into Gusev as a localized unit.

[26] PL_m (Figure 8b) is relatively flat (with a slight north-south slope) and has a lower crater density than MV_m. Most of the larger craters in PL_m appear degraded, although there is a population of small (<1 km diameter) craters with well-defined rims. West-northwest to east-southeast linear dust-devil tracks (Figure 9b), similar to those identified elsewhere in MOC data by *Malin and Edgett* [2001], are superimposed on PL_m, showing the effects of wind activity on this unit. PL_m lacks exposure in eastern Gusev and appears to terminate in the east along a steep escarpment (Figure 9c).

[27] MS_m occurs as flat-topped mesas, flanked by slope debris, with a population of small (<1 km diameter) craters superimposed on mesa-tops (Figure 8c). Exposures of this unit are separated by narrow canyons, which suggest this unit was once continuous and subsequently eroded.

[28] A morphologic unit not distinguishable by its thermophysical properties is the Lobate Unit, LB_m (Figure 8d). LB_m occurs to the east of PL_m in central Gusev and has thermophysical properties similar to WR_t. LB_m can be distinguished by its lobate margins along its eastern boundary (Figure 8d). LB_m extends from the PL_m unit boundary, is deposited against ET_m south of and within Thira crater, and overlies WR_m in central Gusev.

[29] The distinctive morphologic characteristic of ET_m is a series of low knobs, small mesas, and interspersed dunes superimposed upon a relatively flat underlying surface, giving it an "etched" appearance (Figure 8e). Most of the knobs appear to be randomly oriented, whereas some in the southernmost part of this unit show a weak northwest-southeast orientation. In the northwestern parts of ET_m, channel-like features are present, suggesting some fluid modification (Figure 10).

[30] WR_m (Figure 8f) consists of subdued, northeast-southwest and north-south oriented ridges (producing a "wrinkled" appearance) with superimposed craters having degraded rims and infilled floors. The distinctive WR_m morphology is found in northeast and central Gusev and along the floor of the depression in southeast Gusev mentioned earlier. Some of the ridges appear to form longer "fronts" that have been interpreted by *Grin and Cabrol* [1997c] as evidence for rotary currents under a glacier-covered Gusev paleolake. However, ridge orientations are mostly north-south, showing no evidence of changing "rotary" orientations around Gusev.

[31] The TR_m unit (Figure 8g) is exposed crater rim material from Thira crater, with ET_m, LB_m, and WR_m deposited against it. The degraded rim of TR_m lacks a sizable crater population and has inward margins showing several slope breaks (variable elevation) around ~80% of the crater. Observations of the lack of ejecta superimposed upon adjacent units and termination of lateral deposition against TR_m also suggest that the Thira impact was one of the earliest events in Gusev and sampled distinctive strata from depth.

[32] Examination of the area previously identified as HTI_t reveals that, morphologically, the eastern lobe coincides with and shares the same morphology as ET_m. The western lobe shares the same surface textures as PL_m, LB_m, and WR_m, while the depression between the two lobes resembles WR_m with a thin mantling of low-albedo material. Because surface textures for HTI_t vary greatly across this area, it is not a true morphologic unit but an area of PL_m, WR_m, ET_m, and LB_m that share similar nighttime TIR temperatures. A thin mantling of low-albedo material or the mantling in combination with the rough landscape of this area in this region may be responsible for its nighttime TIR signature.

[33] Additional scrutiny of THEMIS and MOC visible imagery (Figure 8h) of the low-albedo areas (defined as the