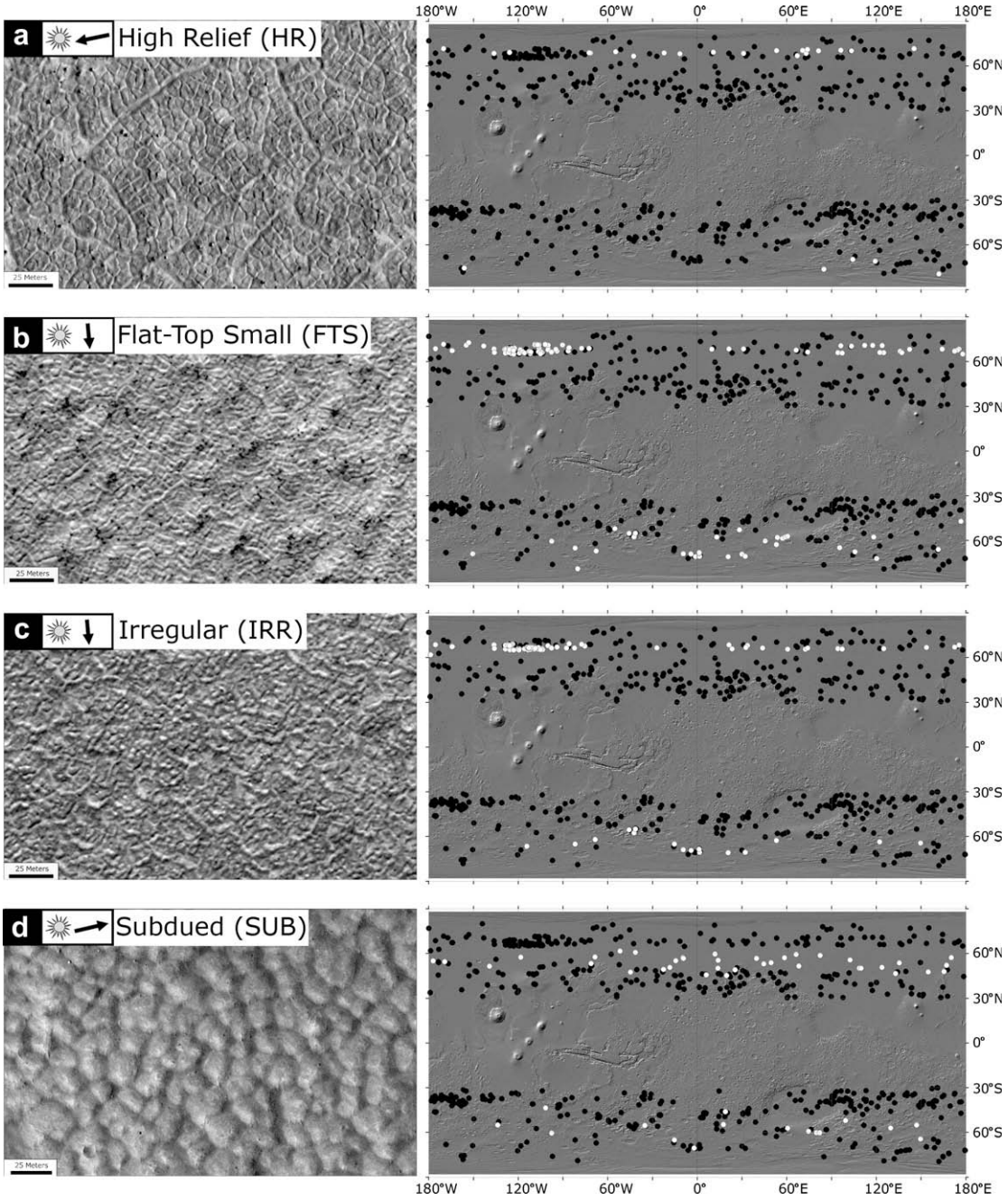

Fig. 1. (Left column) Thermal contraction crack polygons on Mars and (right column) distribution maps of HiRISE images containing the documented polygon morphological group (as defined by Levy et al., 2009c). White dots indicate HiRISE images in which the polygon group can be observed; black dots indicate HiRISE images not featuring the morphological group. North is to image top in all panels. (a) High-relief polygons. Portion of PSP_001474_2520. (b) Flat-top small polygons. Portion of PSP_001959_2485. (c) Irregular polygons. Portion of PSP_001959_2485. (d) Subdued polygons. Portion of PSP_003818_1360. Part B. (e) A gully–polygon system, or "gullygons". Portion of PSP_001357_2200. (f) Peak-top polygons. Portion of PSP_01737_2250. (f) Mixed-center polygons. Portion of PSP_002175_2210.

crack polygon formation on Mars—are polygons recent or relict features? (6) How extensively do polygon-forming processes rework the martian surface, altering our ability to date martian permafrost terrain? (7) How do polygons interact with larger ice-related features on Mars, such as glacial landforms (concentric crater fill, lineated valley fill), and what do these relationships indicate about primary ice precipitation and vapor diffusion over longer-term Amazonian climate? (8) How can terrestrial analogs be used to understand processes occurring in martian thermal contraction crack polygons, and how can terrestrial analog studies be useful in guiding the exploration of martian polygonally patterned ground?

Here, we address these outstanding issues, with the goal of building a synthesis on the basis of the current understanding of martian thermal contraction crack polygons. Conceptually, polygons are a powerful tool for linking several fields of cold regions research, including: (1) landscape geomorphology (Péwé, 1959, 1963, 1974; Berg and Black, 1966; Black, 1982; Bockheim, 2002; Sletten et al., 2003; Marchant et al., 2002, 2007; Marchant and Head, 2007), (2) remote sensing observations (Boynton et al., 2002; Feldman et al., 2002; Kuzmin et al., 2004; Bandfield, 2007), (3) physical modeling of the behavior of frozen materials (Lachenbruch, 1962; Mellon, 1997; Plug and Werner, 2001, 2002; Maloof et al., 2002; Arenson and Springman, 2005; Kowalewski et al., 2006; Kowalewski and Marchant, 2007; Swanger and Marchant, 2007; Kowalewski, 2009), (4) soil properties analysis and classification (Sugden et al., 1995; Bockheim, 2002; Bockheim et al.,