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GEOSITES

The White Mountains of Harrat Khaybar, Kingdom of Saudi Arabia

The dominant rock types of the western Arabian Miocene to recent intracontinental volcanic fields are hawaiite, but subordinate, more felsic rock types, such as benmoreite, mugearite and trachyte, are also known, especially in the largest volcanic fields with the most complex volcanic stratigraphy, such as the Harrat Khaybar (Camp et al. 1991) (Fig. 1a). Harrat Khaybar basal volcanics formed the Jarad Basalt (5–3 Ma) that is overlain by the Murash Basalt (3–1 Ma), and it is capped by the Abyad Basalt (1 Ma—Recent) (Camp et al. 1991). Harrat Khaybar has the most prominent felsic volcanoes of the Arabian Peninsula erupted from a compositionally zoned near-surface magma chamber along an N–S fault zone in the central part of the field (Camp et al. 1991). The "*White Mountains*" of Harrat Khaybar are strikingly different in their appearance and their eruption history to the most landscape-dominant volcano of the field, the Jabal Qidr, which is a hawaiite stratovolcano and believed to have erupted in historic time and emitted dark lava fields (Camp et al. 1991) that are banked against the white comenditic ash and lapilli plain associated with the "*White Mountains.*" The "*White Mountains*" are composed of comenditic lavas including short, but thick obsidian lava flows and pyroclastic successions composed of intercalated small-volume block-and-ash flow, pyroclastic density current and minor air fall units that form very distinct volcanic landforms with white and beige-to-orange colors, making them stand out from the otherwise dark hawaiite, mugearite and benmoreite lava flows, domes, and dome coulees (Fig. 1b, c, d). The "*White Mountains*" refer to a pair of comenditic volcanoes (Baker et al. 1973; Camp et al. 1991): *Jabal Abyad* (Fig. 1b) and *Jabal Bayda* (Fig. 1c, d). Both Arabic names mean "*White Mountain,*" with *Abyad* a masculine and *Bayda* a feminine form of white in Arabic reflecting that Jabal Bayda is a near perfect circular tuff ring with a shallow crater, while Jabal Abyad is a lava dome complex that forms a hill standing about 300 m above the surroundings. Jabal Abyad is the highest volcano of Harrat Khaybar, reaching 2,093 m above sea level, while Jabal Bayda is 1,913 m high. Their age is poorly constrained, but inferred to be between 0.86 and 0.22 My (Camp et al. 1991). While felsic lava domes and tuff rings exist elsewhere (Austin-Erickson et al. 2011; Riggs and Carrasco-Nunez 2004), the significance of the felsic intracontinental volcanism of the Arabian Peninsula is great in terms of understanding the evolution of dispersed magma in near-surface compositionally zoned magma chambers (Camp et al. 1991). A recently initiated *Arabia Geoparks Project* managed by *Afaaq Consulting* at *King Abdulaziz University* in *Jeddah* demonstrated the high geoeducational value of the volcanic landforms of western Arabia and how these could be utilized to understand volcanic hazards and geoconservation (Moufti and Németh 2013). The "*White Mountains*" of Harrat Khaybar will be flagship geotopes with numerous geosites in the provisional volcanic geopark of the region.

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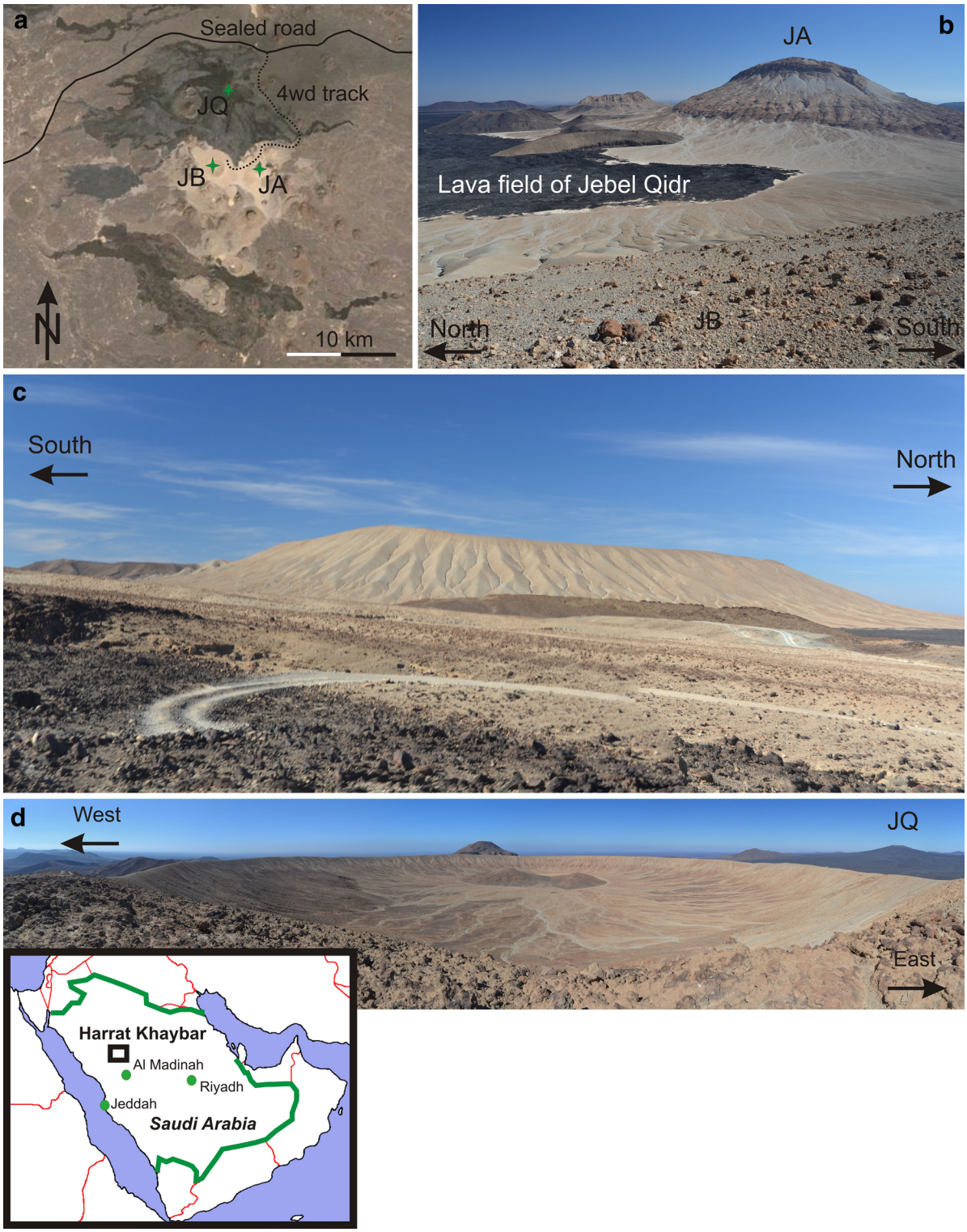

Fig. 1 **a** Harrat Khayber on GoogleEarth image. *JA* Jebel Abyad (25°39′34.09″N; 39°58′14.76″E), *JB* Jebel Bayda (25°39′36.33″N; 39°56′1.30″E), *JQ* Jebel Qidr (25°43′10.56″N; 39°56′35.35″E). Note the white comendite ash plain around the "White Mountains" in the center of the field. **b** Jebel Abyad (JA), a characteristic felsic lava dome complex with a summit crater and typical block-and-ash flow fans. **c** Jebel Bayda (JB) tuff ring is a circular tuff ring with a broad, flat floored crater that hosts two small lava domes. Note the regular gullies on the outer flank of the tuff ring. **d** Jebel Bayda (JB) tuff ring flat floored and enclosed crater with its small lava domes in its middle. In the background, Jebel Qidr (JQ) is visible

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