CHAPTER 3

PRELIMINARY OBSERVATIONS: A FACIES ARCHITECTURE STUDY OF THE LOWER JURASSIC TALKEETNA FORMATION, INISKIN PENINSULA, ALASKA

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Rocks of the Lower Jurassic Talkeetna Formation (Martin, 1926) define a ≥1,000-km-long, northeast-trending belt of volcanic facies within the accreted intraoceanic Talkeetna Arc that stretch from the Chugach Mountains north of Anchorage to the Alaska Peninsula (fig. 3-1). Detterman and Hartsock (1966) divided the Talkeetna Formation into three conformable, continuous stratigraphic members, the Marsh Creek, Portage Creek, and Horn Mountain Tuff. For this study, a facies analysis approach was taken to describe the Talkeetna Formation in the map area in an attempt to better reflect the complexity of volcanic stratigraphy. Volcanic successions tend to be spatially controlled by volcanic vents and rarely contain continuous mappable units.

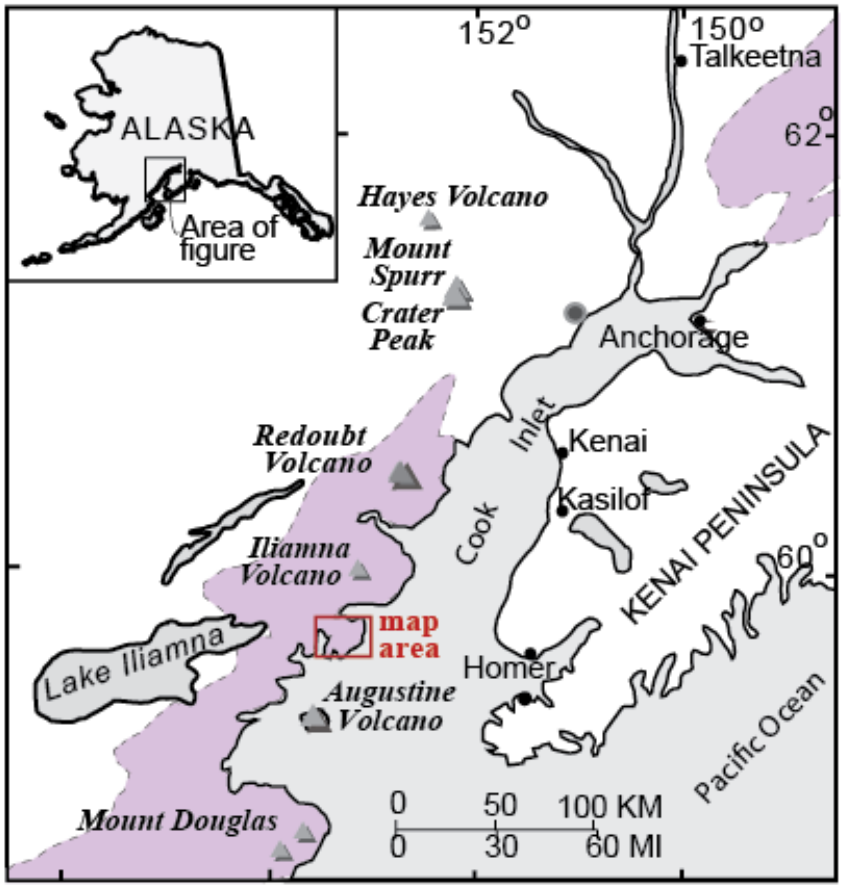

Figure 3-1. Location of Iniskin Peninsula map area (red square), and approximate location of the Talkeetna Arc (in purple) west and northwest of Cook Inlet (modified after Rioux and others, 2010).

Facies of the Talkeetna Formation in the Iniskin Peninsula map area are summarized in table 1. The Marsh Creek and Portage Creek members each consist of predominantly erosionally resistant, mafic to intermediate coherent facies (lavas and subvolcanic sills) that are tens to hundreds of meters thick, and associated monomictic volcaniclastic breccia facies (autoclastic breccias) (fig. 3-2). Possible pillows and fluidal-clast breccias are present locally associated with mafic lavas. The monomictic breccias include hyaloclastites (quench-fragmented autobreccias). Also volumetrically significant in the Marsh and Portage Creek member are non-stratified polymictic volcaniclastic breccia facies. Minor facies include thinly bedded volcaniclastic sandstone to pebble breccia-conglomerate facies (figs. 3-3A–C). No evidence of pyroclastic material was observed.

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TABLE 1.

Marsh–Portage Creek Member

I. Coherent facies association
   A. Coherent facies
      1. Lavas and subvolcanic sills
      2. Dikes and intrusions
   B. Monomictic breccia facies
   C. Fluidal-clast breccia facies
II. Non-stratified polymictic volcaniclastic breccia facies
III. Thinly bedded volcaniclastic sandstone to pebble breccia-conglomerate facies

Horn Mountain Member

I. Coherent facies association
   A. Coherent facies
      1. Lavas and subvolcanic sills
      2. Dikes and intrusions
   B. Monomictic breccia facies
II. Stratified polymictic volcaniclastic breccia-conglomerate facies
III. Thinly bedded volcaniclastic sandstone to pebble breccia-conglomerate facies

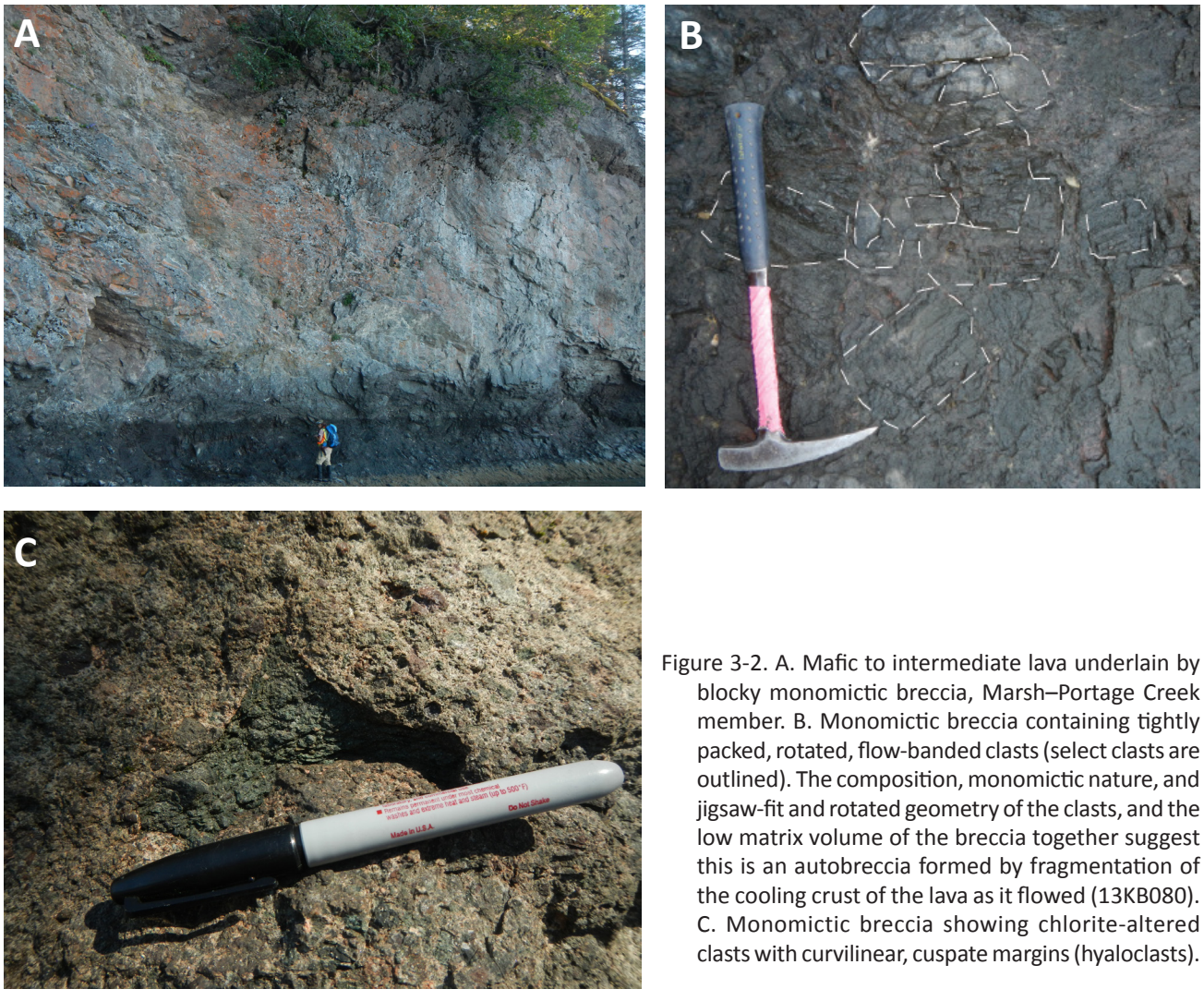

Figure 3-2. A. Mafic to intermediate lava underlain by blocky monomictic breccia, Marsh–Portage Creek member. B. Monomictic breccia containing tightly packed, rotated, flow-banded clasts (select clasts are outlined). The composition, monomictic nature, and jigsaw-fit and rotated geometry of the clasts, and the low matrix volume of the breccia together suggest this is an autobreccia formed by fragmentation of the cooling crust of the lava as it flowed (13KB080). C. Monomictic breccia showing chlorite-altered clasts with curvilinear, cuspate margins (hyaloclasts).

The Horn Mountain member consists mainly of stratified polymictic volcaniclastic breccia-conglomerate facies, with minor mafic-intermediate lavas and sills. Thinly bedded volcaniclastic sandstone to pebble breccia-conglomerate facies also are present in the Horn Mountain member (fig. 3-3D). The composition in terms of clasts and matrix of the stratified facies is similar to non-stratified facies in the Marsh and Portage Creek members. The majority of the Horn Mountain facies are nonresistant and well weathered.

The Marsh Creek and Portage Creek members are indistinguishable in terms of lithofacies, and therefore the two members are combined combined into one member, the Marsh–Portage Creek member. However, facies of the Horn Mountain member are consistently separate and distinct, so the nomenclature of the Horn Mountain member is upheld.

Within the Marsh–Portage Creek member, the predominance of coherent lavas, the substantial volume of in situ and resedimented autoclastic breccias present, and the apparent paucity of pyroclastic material indicate that either the eruptive environment was primarily effusive, or syn-eruptive deposits of pyroclastic material were not well preserved. The thickest lava flows are hundreds of feet thick and underlie the highest peaks in the map area, suggesting that the peaks may be remnants of effusive eruptive centers.

In contrast, the Horn Mountain member contains the majority of weakly to well-bedded volcaniclastic deposits. Coherent facies that are present in the area tend to be thin and relatively small in volume; this area is therefore interpreted to represent deposition distal to the eruptive center(s).

Numerous observations are consistent with a marine environment of deposition for the Talkeetna Formation in the map area: the presence of hyaloclastite breccias that record quench fragmentation at the lava-water interface during effusion; structureless volcaniclastic breccias that suggest rapid or en masse deposition from sediment-water slurry flows and are consistent with subaqueous volcanic activity on the flanks of one or more growing effusive edifice(s); and thinly bedded volcaniclastic siltstone and sandstone facies, suggestive of deposition from sediment gravity flows and probable deposition of fine volcaniclastic material from suspension.

All Talkeetna Formation rocks have been altered to varying degrees. Based on field observations, alteration assemblages in the Marsh–Portage Creek member include local and patchy chlorite $\pm$ sericite $\pm$ albite, likely resulting from diagenesis, and less common zeolite and/or clay assemblages. Rocks of the Horn Mountain member in the map area, however, are noticeably softer and less resistant, suggesting they have been altered to zeolites and/or clay assemblages.

In summary, the Talkeetna Formation in the Iniskin Peninsula map area forms a belt of submarine volcanic facies dominated by lavas, sills, and related in-situ and resedimented autoclastic breccias. Polymictic volcaniclastic slope deposits and volcaniclastic turbidites are subordinate in volume. Resistant facies are dominated by proximal deposits that make up the Marsh–Portage Creek member. Less resistant, more distal, and well-bedded debris flows predominate in the Horn Mountain member.

A more detailed interpretation of facies, facies architecture, and post-depositional alteration and deformation of the Lower Jurassic Talkeetna Formation volcanic succession will be presented in a future publication.

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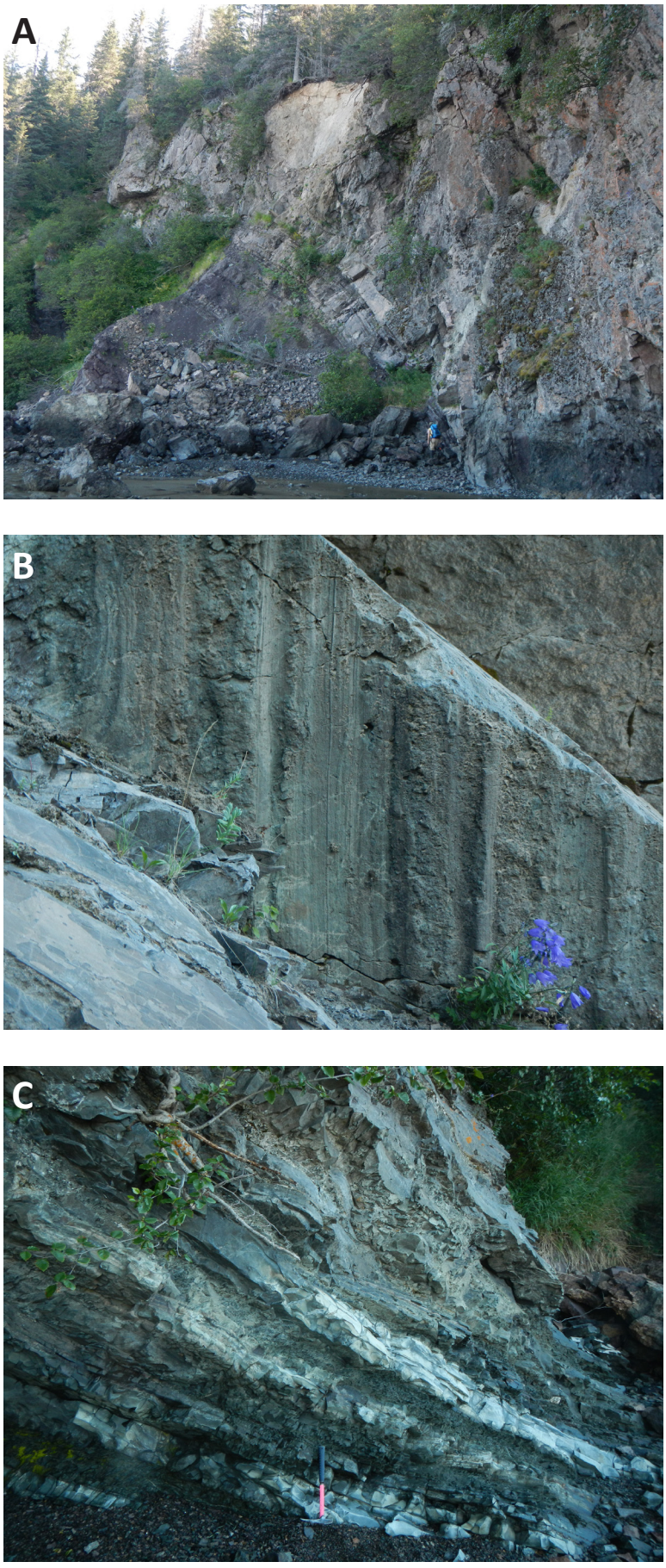

Figure 3-3. Thinly bedded volcaniclastic siltstones and very-fine- to fine-grained sandstones in the Marsh–Portage Creek member in two coastal outcrops (13KB080). A. Volcaniclastic siltstones, graded sandstones, and granule breccia-conglomerates with occasional outsized cobbles are intercalated between an amygdaloidal basalt(?) autobreccia at the base and autobreccia and basalt seen in figure 3-2, conformably overlying the sediments. B. Looking up at tool markings at the base of a medium-grained volcaniclastic sandstone within outcrop in A. C. Thinly bedded volcaniclastic siltstones and fine- to medium-grained sandstones ~100 m north of outcrop in A. D. Thinly bedded volcaniclastic siltstone, sandstone, and pebble breccia-conglomerate crop out within the Horn Mountain member (13KB105).