CHAPTER 4

PRELIMINARY OBSERVATIONS: CONTINUED FACIES ANALYSIS OF THE LOWER JURASSIC TALKEETNA FORMATION, NORTH CHINITNA BAY, ALASKA

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Field studies in 2014 continued the detailed, 1:63,360-scale geologic mapping associated with the Cook Inlet basin analysis program. In 2013, the focus was on inch-to-mile mapping of the Iniskin Peninsula, lower Cook Inlet, and included mapping of the Lower Jurassic Talkeetna Formation (Martin, 1926; Detterman and Reed, 1980; Bull, 2013, 2014). The mapping area in 2014 extended from Chinitna Bay to Tuxedni Bay, with the main focus on the area from Chinitna River to Red Glacier, north of Chinitna Bay (fig. 4-1). This short report is intended as a continued discussion of preliminary observations reported in Bull (2014).

North of Chinitna Bay, the Talkeetna Formation forms a northeast-trending belt of volcaniclastic sediments, lava flows, lava domes, and possible sills. These facies have been identified between Iliamna Volcano and its Quaternary deposits to the north and west, and the Bruin Bay fault to the east. Prior to 2013, detailed stratigraphic analysis of the Talkeetna Formation had been limited to facies in the Talkeetna Mountains, north of Anchorage (for example, Draut and Clift, 2006). In 2013 a high concentration of very thick lavas was identified around Roscoe Peak and Mt. Eleanor on the Iniskin Peninsula, which suggests one or more effusive eruption centers (Bull, 2013, 2014). The facies north of Chinitna Bay do not include such a concentration of lavas; effusive eruptive centers are not apparent. Instead, ridges running north from the bay are underlain

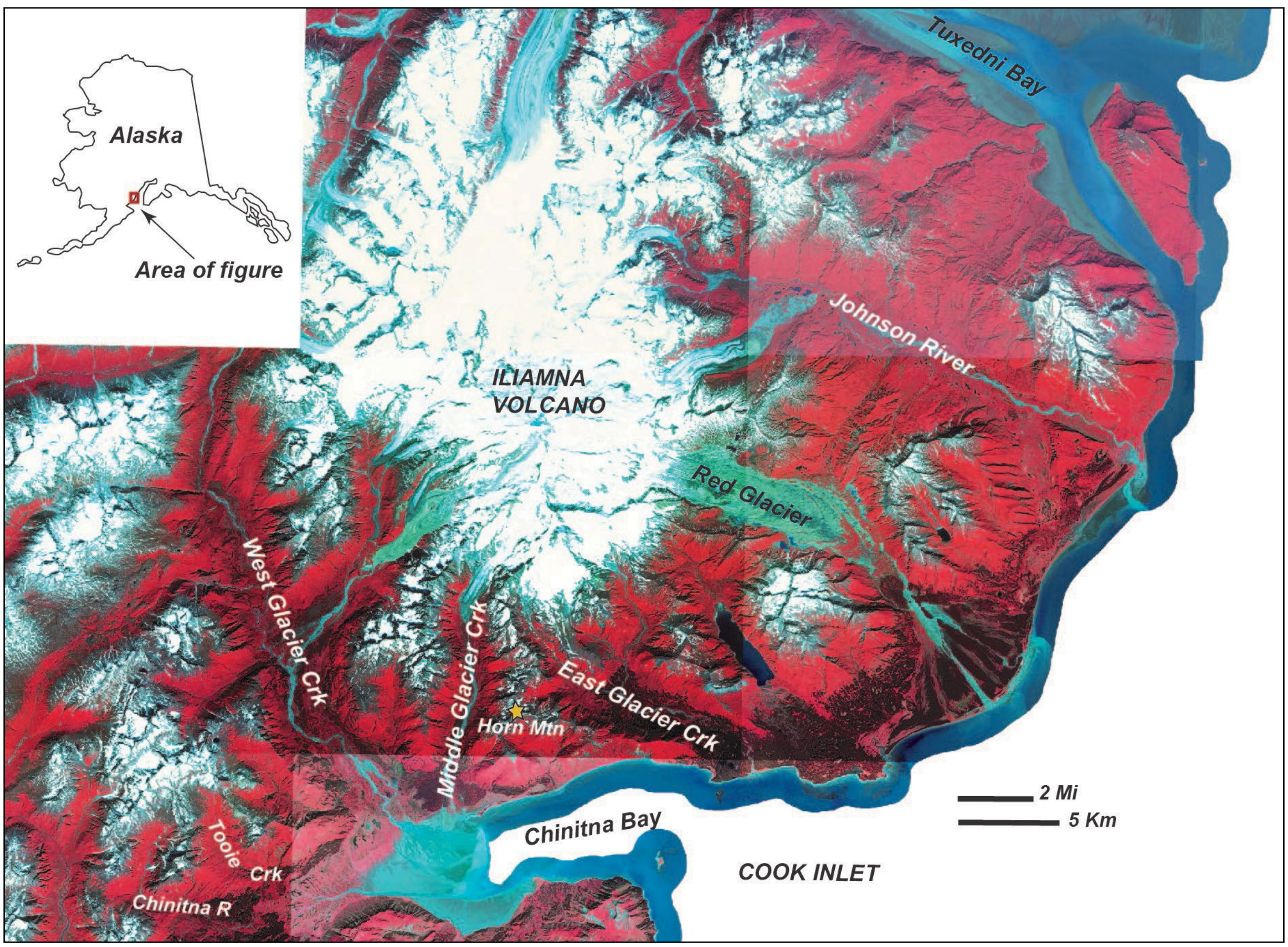

Figure 4-1. Location of Iniskin–Tuxedni map area.

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by lavas interbedded with internally structureless volcaniclastic pebble breccias and poorly sorted, angular, volcaniclastic sandstones. The volcaniclastic deposits are full of angular, intermediate to mafic, porphyritic to aphanitic lava clasts, suggesting the beds represent mass flow deposits transported relatively short distances on volcanic slopes, likely from the north. In addition, the frequency of lavas increases northward, suggesting the source vents may be covered by the younger deposits of Iliamna Volcano and its associated vents (Waythomas and Miller, 1999).

Explosive volcanism also occurred in the map area, clearly evident in thin sections made from samples collected in 2013 and 2014 (fig. 4-2). The sections reveal shard- and pumice-bearing pyroclastic deposits preserved in thinly bedded deposits in several areas, including south of Roscoe Peak, on Horn Mountain ridge, Chinitna ridge, and possibly in Tuxedni Bay. Preservation of the delicate bubble-wall shards and pumice fragments provides evidence not only of explosive volcanism, but also of the directly eruption-fed, non-transported nature of some of the deposits.

Additional volcaniclastic facies in the 2014 map area provide evidence of deposition in shallow marine and possibly fluvial environments. A somewhat discrete zone (southern Horn Mountain ridge) of thinly bedded, laterally continuous beds locally exhibits cross-laminations, channel fills, normal grading, and lenticular beds (fig. 4-3). The units also show characteristics such as subrounded clasts and oxidative coloring of the beds that together are possibly indicative of subaerial–alluvial and perhaps even lacustrine deposition. In addition, in the southern Horn Mountain ridge package, approximately 800 m (0.5 mi) north of Horn Mountain, we observed a cliff-forming, altered, 8–10-m-thick, brown, very-coarse-grained volcaniclastic sandstone to pebble breccia that is structureless to weakly laminated and contains flattened, altered, white–pink pumice and polymictic coherent clasts. The breccia also contains approximately 10 percent fossilized logs, 10 cm to 1 m in diameter at the base of the unit (fig.4-4). The logs are elongate parallel to bedding, as if lying down. Immediately underlying the pumice breccia is a 1–2-m-thick bed with brown siltstone to very-fine-grained sandstone matrix and 10–25 percent white–pink

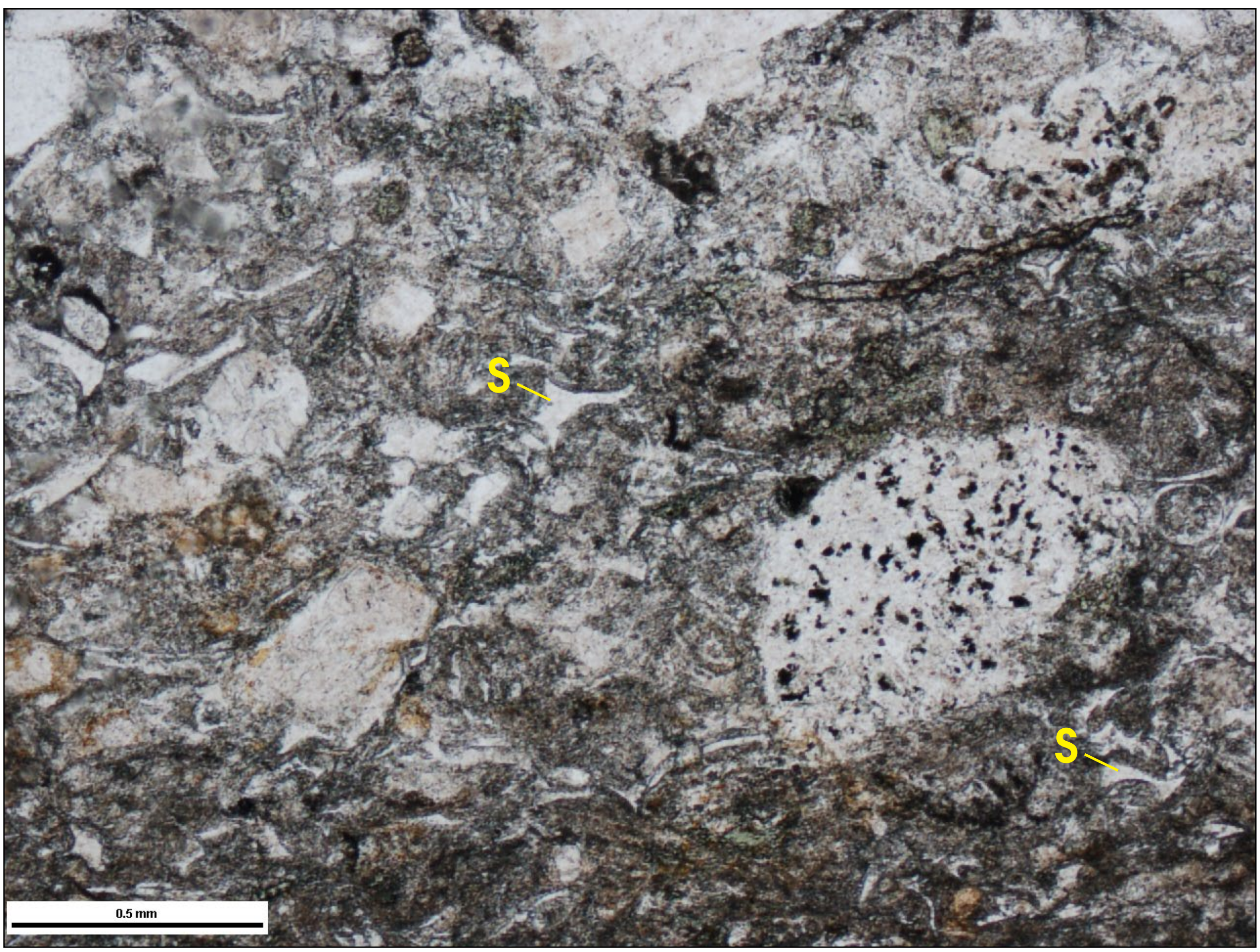

Figure 4-2. Bubble-wall shards (white, curvilinear shapes, S) in volcaniclastic sandstone. The shard clasts are the result of pulverization of magma during explosive eruption in predominantly intermediate to silicic magmas. Preservation of these delicate features suggests eruption-fed (pyroclastic) deposits laid down in quiet water.

pumice and/or aphanitic coherent clasts, and 1–3 percent, 4 mm to 2 cm, black, angular, lithic (siliciclastic?) clasts. The bed is weakly laminated. Together, these two units—the log-bearing pumice breccia and the lithic-bearing laminated basal unit—likely represent a pyroclastic density current (PDC) deposited in a subaerial or shallow aqueous environment. Underlying the PDC deposit are several 20–50-cm-thick maroon and olive green volcaniclastic fine-grained sandstone and siltstone beds (fig. 4-5). These beds contain sedimentary structures such as channel fills, crossbeds and lenticular beds (fig. 4-6).

Thinly bedded and laterally continuous volcaniclastic beds are also exposed along the ridge west of Horn Mountain ridge, and are folded into an east–west-striking syncline. The facies in this area, however, include siliciclastic black siltstone and gray cherty layers not indicative of fluvial deposition. High-angle faults displace units with varying offset on both ridges (Gillis, 2014), and the relationship between the thinly bedded facies on the neighboring ridges is not clear.

Marbles are exposed in the Iniskin–Tuxedni map area in a number of locations, the majority of which lie in the contact zone between the intrusions of Alaska–Aleutian Batholith and the Talkeetna Formation. The marbles were previously mapped as part of the Triassic Kamishak Formation (Trm; Detterman and Hartsock, 1966); however, mapping completed during this study suggests their stratigraphic position may be within the Talkeetna Formation. One marble exposure not previously mapped is immediately northeast of the Chinitna River, proximal to the batholith but not in contact with it. The marble is interbedded with poorly sorted volcaniclastic sandstones and pebble breccias (fig. 4-7). Beds overlying the marble are ≤10-cm- to 2-m-thick, pumice-bearing volcaniclastic granule to pebble breccia and medium- to coarse-grained, poorly sorted volcaniclastic sandstone. Overlying and along strike with these pumice-bearing units are internally structureless to laminated and cross-bedded, crystal-rich, moderately-well-sorted volcaniclastic sandstones and conglomerate–breccias with subangular to subrounded clasts (fig. 4-8). Underlying the marble are thickly- to moderately-bedded, internally structureless, chlorite+epidote-altered, mafic to intermediate, volcaniclastic siltstone, sandstone, and pebble breccia.

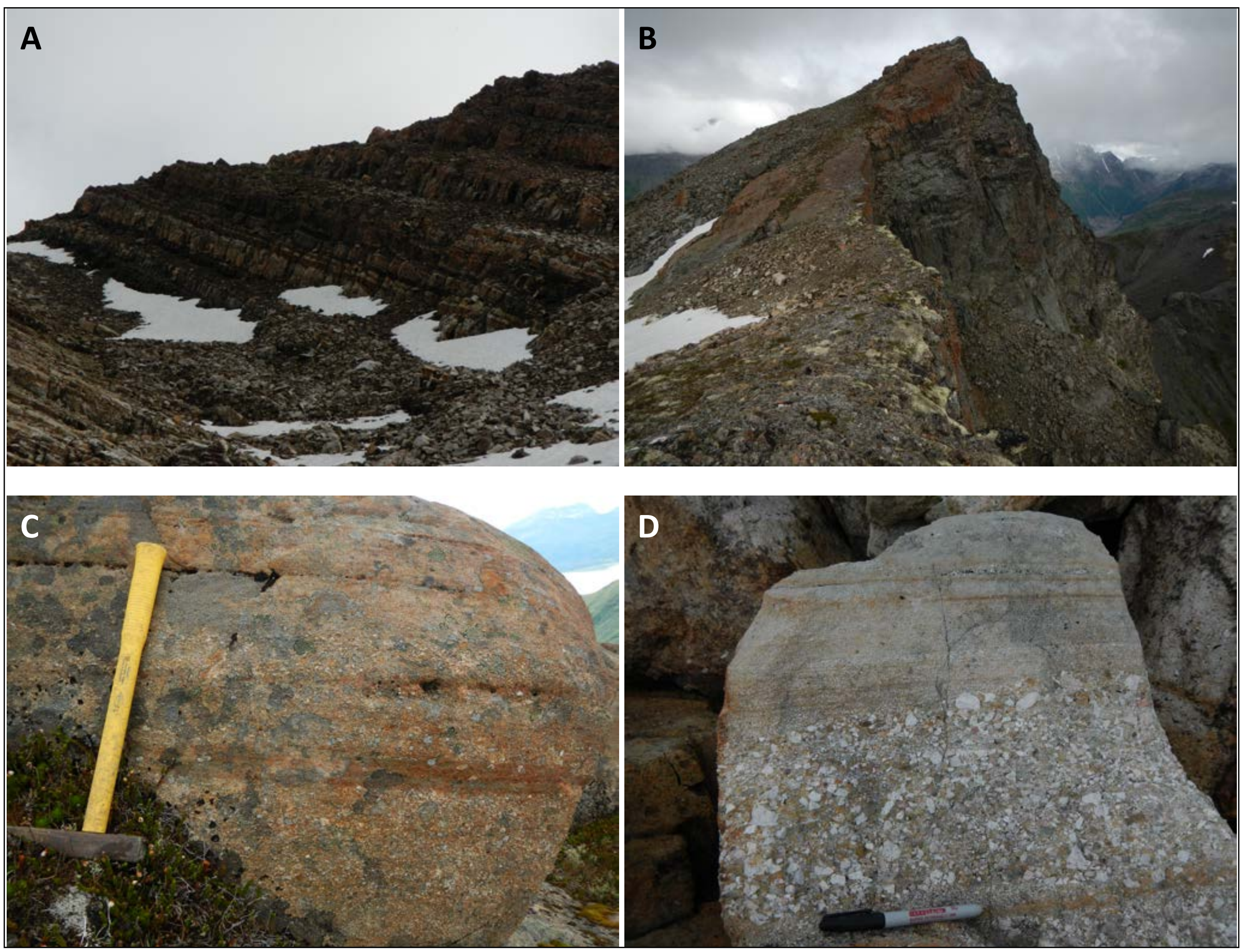

Figure 4-3 A–D. South-dipping, thinly-bedded, laterally continuous outcrops of volcaniclastic siltstone, sandstone, and pebble breccia along southern Horn Mountain ridge. Some beds are laminated (image C), normally graded (image D), and exhibit structures such as cross-laminations and lenticular bedding.

The volcaniclastic facies associated with the marble do not exhibit unique characteristics that distinguish them as part of the Triassic package. Field observations made during a half-day investigation of the Triassic Cottonwood Bay Greenstone yielded few revelations either; the exposures along the north and west shores of Cottonwood Bay comprise chlorite+epidote-altered lower fine- to upper medium-grained volcaniclastic sandstone, and mafic autoclastic breccia, including hyaloclastite (fig. 4-9). Similar facies were observed in the Roscoe Glacier area in the Iniskin–Tuxedni map area (Bull, 2013). In hopes of determining the age of the carbonates exposed in the map area, multiple samples were taken of the carbonates and/or the volcaniclastic rocks above and below the carbonate for possible conodonts, and U-Pb and $^{40}Ar/^{39}Ar$ dating; results are pending.

Detterman and Hartsock (1966) split the Talkeetna Formation into three members: in ascending order, the Marsh Creek Breccia Member, Portage Creek Agglomerate Member, and the Horn Mountain Tuff Member. In 2013, due to similarities in the facies of the Marsh Creek and Portage Creek Members on the Iniskin Peninsula, and the inability to separate these along regional strike, the two members were combined into one member, and the Horn Mountain Member remained separate (Bull, 2013, 2014). However, rapid facies changes and complex stratigraphy render volcanic successions difficult to subdivide into continuous mappable units along strike, and the facies of the Horn Mountain Tuff Member vary markedly from Iniskin Bay to Chinitna Bay to Tuxedni Bay. Overall preliminary observations presented here suggest the arc may have become shallower, and even subaerial, locally, but the facies included in the Horn Mountain Tuff Member do not reflect common characteristics consistent enough to define a distinctive member. Further work may allow subdivisions of the Talkeetna Formation into groups of facies, or facies associations, but these will likely vary across the regional strike.

Figure 4-4 A–C. Fossilized logs (marked by arrows) in crystal pumice lithic breccia (see fig. 4-6). The logs are elongate parallel to bedding. Images **B** and **C** are enlargements of fossilized logs denoted as X and Y in image A. Rock hammer is 50 cm long.

Figure 4-5. Maroon and olive green fine-grained volcaniclastic sandstone and siltstone beds underlying log-bearing, crystal pumice lithic breccia.

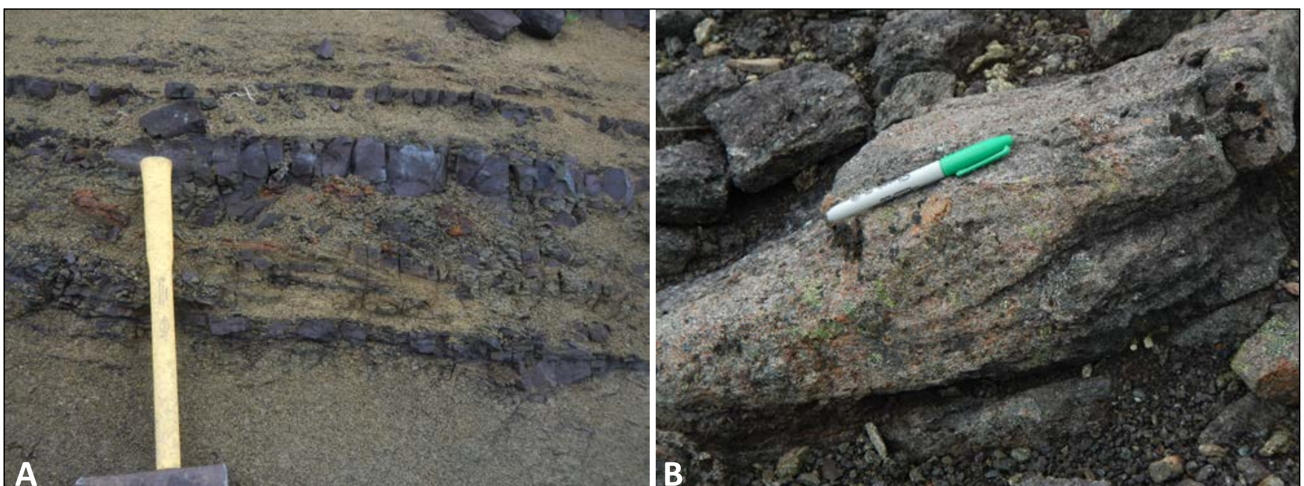

Figure 4-6. Cross-laminations (A and B) and lenticular beds (C) in strata underlying log-bearing, crystal pumice lithic breccia interpreted to be a pyroclastic density current (PDC) deposit. Hammer is 50 cm long.

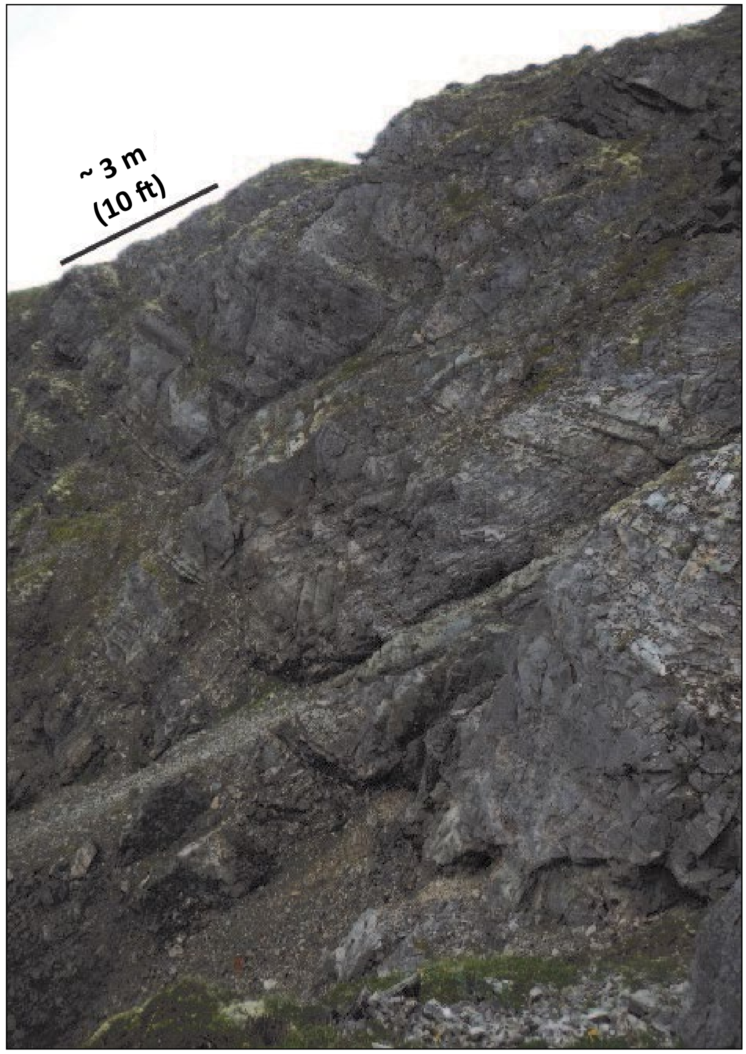

Figure 4-7. Bedded marble on Chinitna ridge, ~3 m wide, intercalated with volcaniclastic sandstone and pebble breccia.

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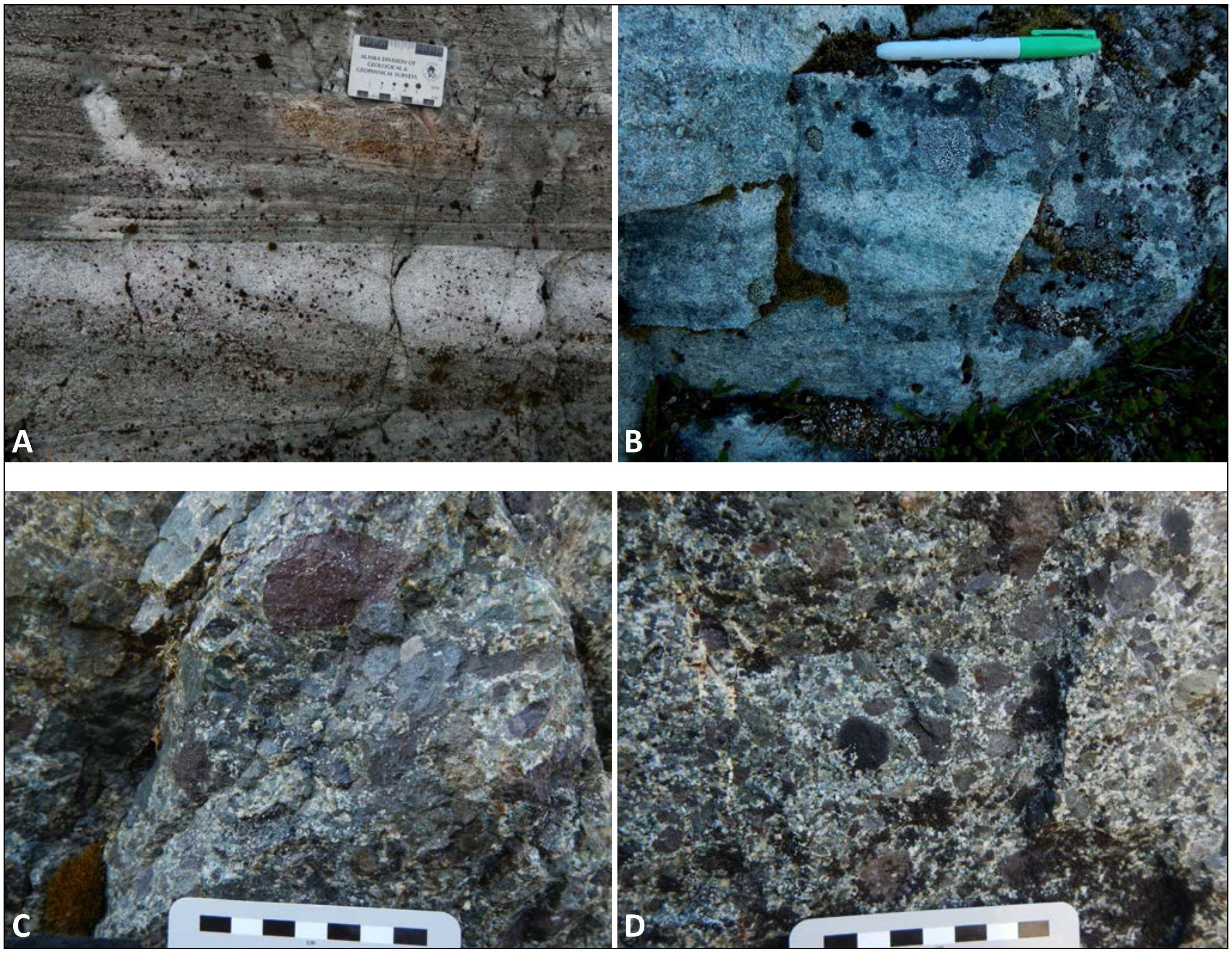

Figure 4-8. Crystal-rich volcaniclastic sandstones and conglomerate-breccias on Chinitna ridge, along strike from beds overlying the marble seen in figure 4-7. **A, B.** Cross-laminated medium- to coarse-grained volcaniclastic sandstone. **C, D.** Polymictic volcaniclastic pebble-conglomerate–breccia.

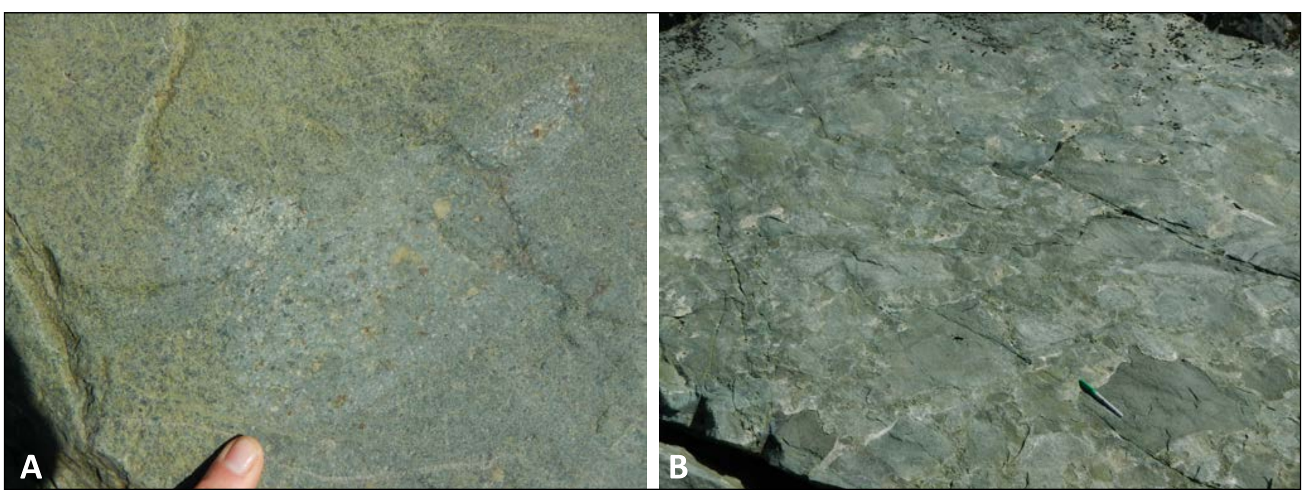

Figure 4-9. Triassic Cottonwood Bay Greenstone facies, Cottonwood Bay. **A.** Porphyritic clast within chlorite–epidote-altered, medium- to coarse-grained volcaniclastic sandstone. **B.** Chlorite–epidote-altered autoclastic breccia with tightly packed blocky clasts and hyaloclasts. Clasts with cuspate and curvilinear margins are likely quench-fragmented hyaloclasts, such as the clast to the right of the green marking pen (lower right corner of photo).

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