ROCK STRENGTH PROPERTIES OF THE HAINES-TAKSHANUK MOUNTAINS-CHILKAT PENINSULA AREA STATEMAP PROJECT, SOUTHEAST ALASKA

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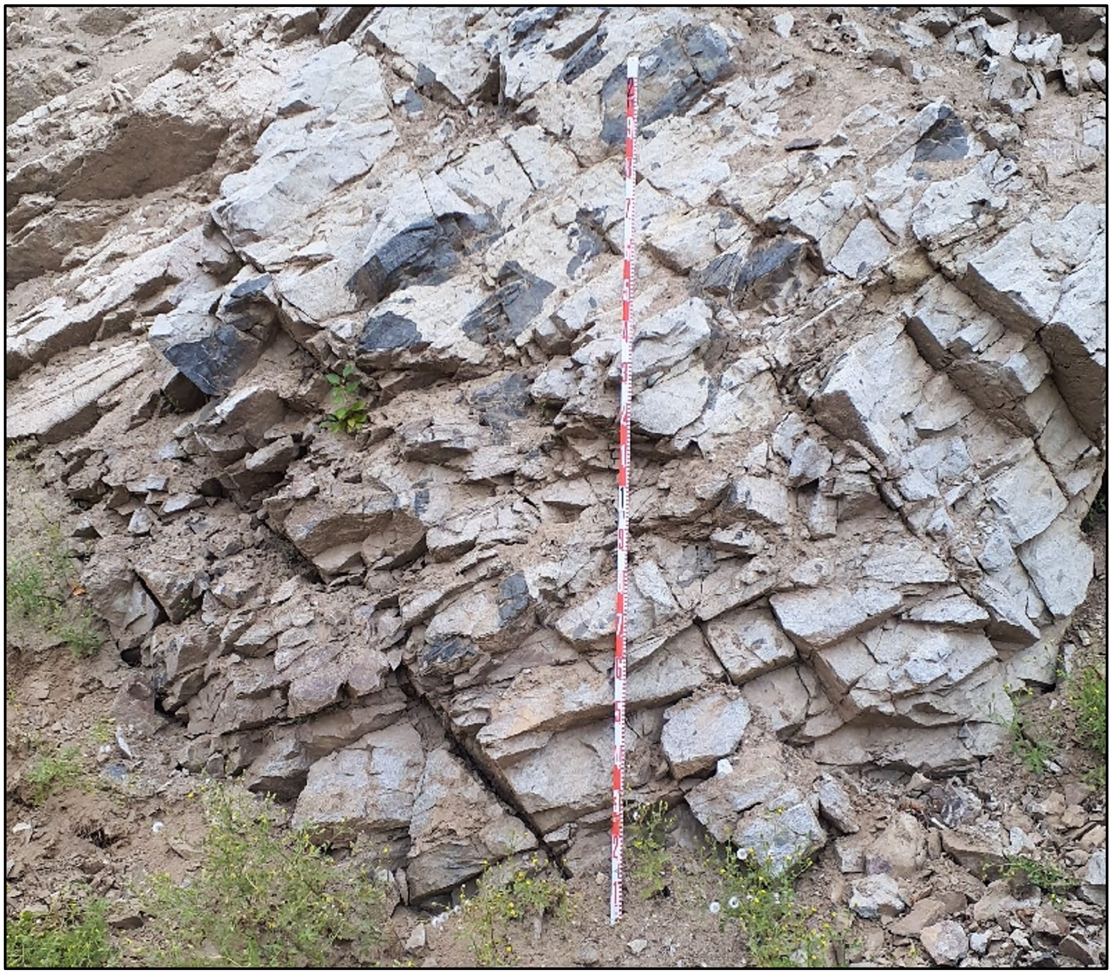
Raw Data File 2024-28



Photograph of rock outcrop sampled in the Haines area as part of this study. The scale is in meters.

This report has not been reviewed for technical content or for conformity to the editorial standards of DGGS.

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ROCK STRENGTH PROPERTIES OF THE HAINES-TAKSHANUK MOUNTAINS-CHILKAT PENINSULA AREA STATEMAP PROJECT, SOUTHEAST ALASKA

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INTRODUCTION

In response to the deadly December 2, 2020, landslide in Haines, Alaska, Alaska's Geologic Mapping Advisory Board endorsed mapping the Haines area. The project area includes portions of the Skagway A-1, A-2, B-1, B-2, and B-3 15-minute quadrangles, an area of approximately 777 square kilometers (300 square miles; fig. 1) and produced a 50,000-scale bedrock and surficial geologic map of the Haines Takshanuk Mountains-Chilkat Peninsula area of Southeast Alaska (Larsen, 2024). This data release is part of that larger project and includes Schmidt hammer testing for selected in situ rock outcrops and unconfined compressive testing of selected rock cores. Digital data are available as comma-separated value (.csv) files from doi.org/10.14509/31416.

METHODS

Sample Collection

In August of 2023, field teams from the Alaska Division of Geological & Geophysical Surveys (DGGS) and the University of Alaska Fairbanks (UAF) conducted Schmidt hammer testing on 30 rock outcrops at selected field station locations and collected rock samples from four locations for unconfined compressive strength (UCS) testing (fig. 1). We recorded location information using GPS-enabled tablets running Esri's ArcGIS Field Maps app, with a reported horizontal error of approximately 5 to 10 meters (Truskowski and others, 2024). Latitude and longitude are reported in the WGS84 coordinate system.

Sample identification numbers are the same as station numbers in locations where Schmidt hammer tests were conducted or where only one rock sample was collected. Where multiple samples were collected, sample identification numbers consist of the station number plus an additional letter.

In Situ Testing with Schmidt Hammer

The Schmidt hammer was originally designed for non-destructive concrete testing and has been widely used for rock strength testing in the field and in the lab. The hammer is pressed perpendicularly against the concrete or rock surface until the spring-loaded piston rebounds. The rebound values displayed on the scale can be correlated to compressive strength using a conversion chart. Harder materials have a higher rebound value. We used Schmidt hammer

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types L and N, which are specifically designed for rocks and manufactured by Proceq, at each selected outcrop to assess the compressive strength of the rock. We took ten readings at each location using each hammer type. The average of these readings is assumed to represent the rock mass. This average value and the standard deviation are reported in the csv file. Despite American Society for Testing and Materials (ASTM) D5873-14 “Standard Test Method for Determination of Rock Hardness by Rebound Hammer Method” being withdrawn in early 2023 (ASTM International, 2014a), a work order was issued in November 2023 to reinstate it (ASTM International, 2023); therefore, we performed the tests in general accordance with ASTM D5873-14 with the exception that we did not use a grinding stone to smooth in situ rock surfaces.

Type N hammers have an impact energy of 2.207 Nm (1.63 ft pound-force [lbf]) and are designed for testing a rock exposure that is 100 mm (4 in) or more in thickness and has a compressive strength between 10 and 70 Newtons (N)/mm^2 (1,450 to 10,152 psi; Gilson Company, Inc., 2024b). Type L hammers are designed for thinner rock slabs and have one-third less energy than type N hammers, impacting with 0.74 Nm (0.54 ft lbf) of energy (Gilson Company, Inc., 2024a). The impact energy is reduced and scattered by discontinuities and irregularities in the rock; therefore, we tested the rock face at least 6 cm (2.36 in) away from visible fractures and discontinuities. Because of this, testing was performed where the rock appeared most intact rather than being conducted on a grid pattern. Irregularities within the rock mass that we could not see on the surface may have affected some readings. Because of its greater impact force, we found that the type N hammer was more likely to produce rock chips during testing than the type L hammer, which may also have affected some readings.

Unconfined Compressive Strength Testing

We collected rock samples representing major rock types in the region for UCS testing. We collected at least five samples of each rock type that could potentially yield cores longer than 10.2 cm (4.0 in); because of weight and space constraints in transporting samples to Fairbanks, we only collected samples from four selected locations (fig. 1). We submitted samples to the Frozen Soil Testing Laboratory at UAF for preparation and testing.

Testing was performed in accordance with ASTM D7012-14e1, “Standard Test Methods for Compressive Strength and Elastic Moduli of Intact Rock Core Specimens under Varying States of Stress and Temperatures, Method C” (ASTM International, 2014b). To obtain the 2:1 length-to-diameter ratio required by this method, a 5.08 cm (2 in) diameter coring bit was used to obtain cores that were then trimmed to a length of 10.16 cm (4 in). Depending on the dimensions and competency of the collected rock samples, up to four cores were obtained from each rock and subjected to UCS testing. The number of cores obtained from each sample, the average UCS value, and standard deviations are reported in the .csv file.

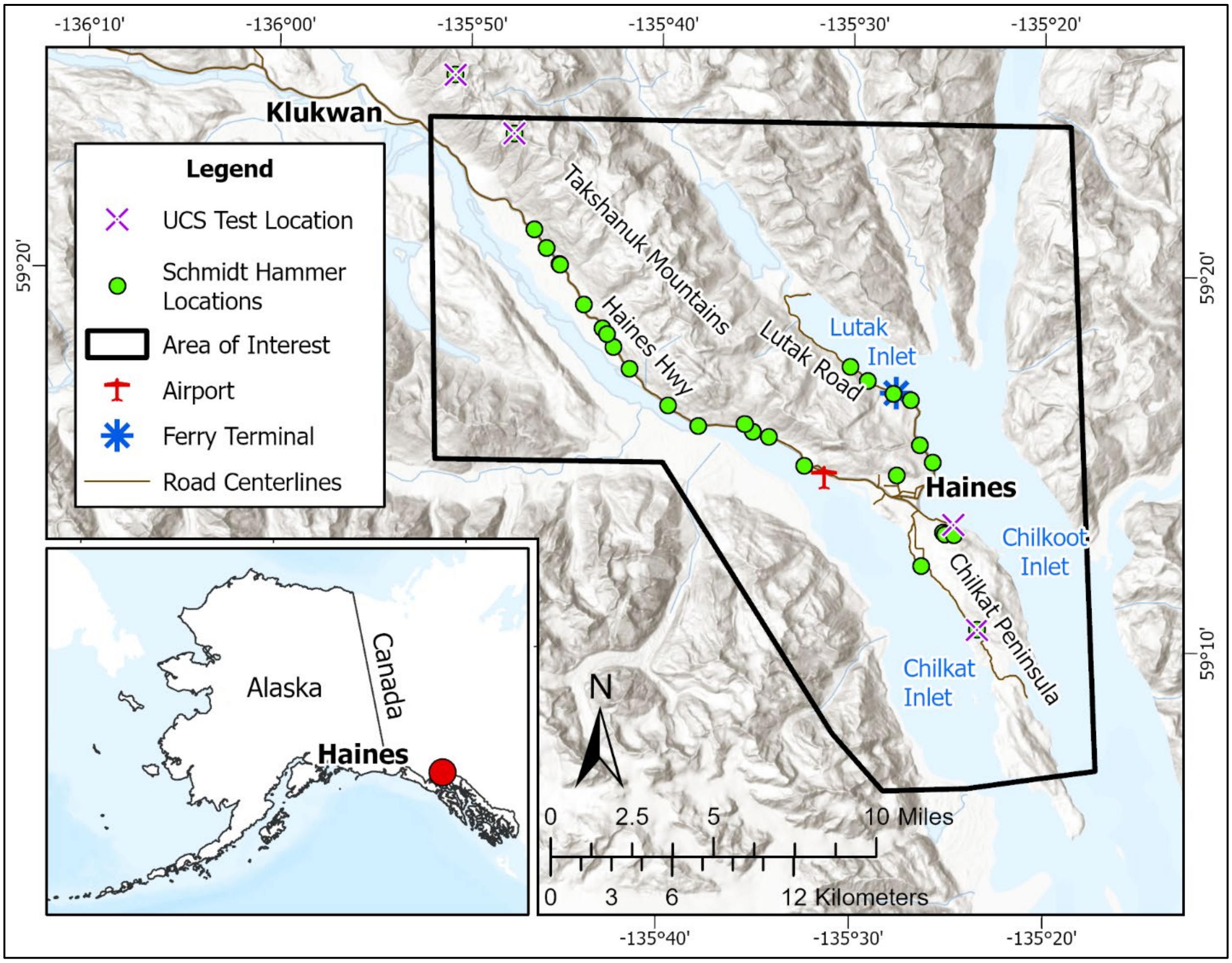

Figure 1. Project area map showing locations where Schmidt hammer testing was conducted and locations where rock samples were collected for unconfined compressive strength (UCS) tests.

ACKNOWLEDGMENTS

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