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GIS Coverages of the Castle Mountain Fault, South Central Alaska

by

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Abstract

The Castle Mountain fault is one of several major east-northeast-striking faults in southern Alaska, and it is the only fault with had historic seismicity and Holocene surface faulting. This report is a digital compilation of three maps along the Castle Mountain fault in south central Alaska. This compilation consists only of GIS coverages of the location of the fault, line attributes indicating the certainty of the fault location, and information about scarp height, where measured. The files are presented in ARC/INFO export file format and include metadata.

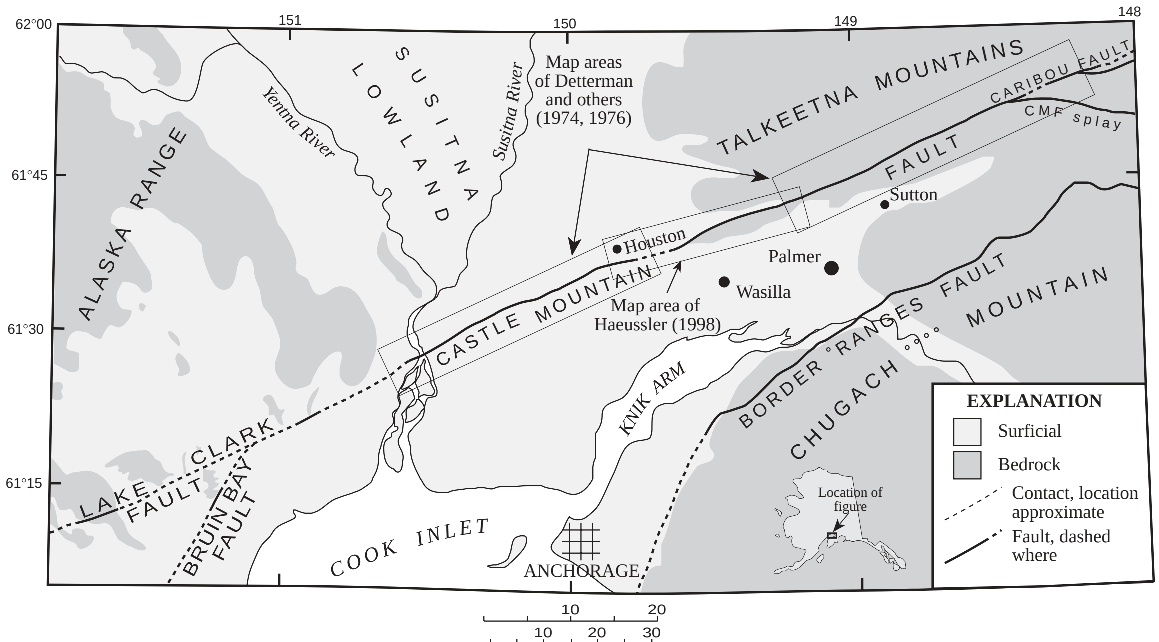

Figure 1. Location of Castle Mountain fault in south central Alaska, and previous USGS maps along the fault.

Introduction

The Castle Mountain fault is one of several major east-northeast-striking faults in southern Alaska, and it is the only fault with historic seismicity and Holocene surface faulting (Lahr and others, 1986; Detterman and others, 1974). The Castle Mountain fault is approximately 200 km long, and is one of the longest structures in the Cook Inlet basin. Martin and Katz (1912) first noted the fault, but it was delineated on a regional scale by Detterman and others (1974, 1976). They mapped and divided it into two physiographic segments: the western Susitna Lowland and eastern Talkeetna Mountains segments (Fig. 1). Haeussler (1994, 1998) mapped and examined the 30-km-long region between the two Detterman and others (1974, 1976) maps.

This report is a compilation of the three USGS maps that cover the location of the Castle Mountain fault in some detail (Detterman and others, 1974, 1976; Haeussler, 1998), with the purpose of providing land managers with an authoritative source for the location of the fault in the Talkeetna Mountains and Susitna Lowland. There are other maps that also cover parts of the Castle Mountain fault (Reger and others, 1995a,b,c; Clardy, 1974; Fuchs, 1980), but these do not alter the location of the fault. Thus far, there are no land use or building regulations associated with proximity to the Castle Mountain fault.

The surface trace of the Castle Mountain fault is not the only earthquake hazard associated with the fault. The two historic earthquakes on the Castle Mountain fault were located on the part of the fault where there is no surface expression (Lahr and others, 1984), and thus even the part of the fault with no scarp should probably be considered active. In addition, Haeussler and others (2000) showed there is a 3-4 km wide fault-cored anticline on the north side of the fault near Houston. The faults in the core of the anticline do not crop out at the surface, but certainly also represent a seismic hazard. Saltus and others (2001) use aeromagnetic data to show that this anticline continues for the length of the Castle Mountain fault in the Susitna Lowland.

Methodology

The Haeussler (1998) map was the easiest to include in this compilation. It was published at 1:25,000-scale, and was already available digitally and included metadata (http://geopubs.wr.usgs.gov/open-file/of98-480/).

The Detterman and others (1974) map along the Castle Mountain fault was the most difficult to capture. This report consisted of three 1:24,000-scale aerial photograph strips along the fault, with point annotations on the photographs. The photographs had not been registered or rectified. In order to georeference the data it was digitized in straight table coordinates, and then registration points were established between the photographs and georeferenced images of USGS topographic maps. Due to the lack of prominent features on the photographs the registration points could not be located with as much precision as desired. To compensate for this the faults and points were rubber sheeted to the images of the topographic maps after registration. However, the locations of these faults should still be considered less accurate then those from the other sources.

The Detterman and others (1976) map along the eastern end of the fault is at1:63,360-scale, and was digitized from a paper copy of the map. This map was drawn over a topographic base, so it could be registered without accuracy problems. All faults on the map were digitized. These included not only the Castle Mountain fault, but the Caribou fault as well.

There was some overlap in the three geologic maps, and we used the Haeussler (1998) map in the overlap areas. There was a slight difference in the location of the main trace of the fault at the western end of the Haeussler (1998) map and the Detterman and others (1974) map. We used the lines from the Haeussler (1998) map and adjusted the position of one fault on the Detterman and others (1974) map to match up within a half-mile distance west of the Haeussler (1998) map. At the eastern end of the Haeussler (1998) map one small fault was completely removed from the Detterman and others (1976) map while the two main fault traces were trimmed and the northern portion was matched to a fault on the Haeussler (1998) map.

Discussion of Line Types

The Haeussler (1998) map identified the following line types: fault; fault, approximate location; fault, probable location; fault, possible location; fault, concealed; and lineations. The first four fault types are listed in descending order of certainty.

The faults for the Detterman and others (1974) and (1976) maps were attributed based on the coding scheme previously established by the Haeussler (1998) map. This allowed us to be consistent when the three maps were merged. However, based on the descriptions from the Detterman and others (1974) and (1976) maps we decided to code the faults using only three levels of uncertainty instead of four. Thus any fault whose description was equivalent to a "probable location" was given the same code as faults with an "approximate location." The faults that were lumped together have been given an additional attribute parameter that can be used to distinguish them. There is also a parameter to distinguish portions of the fault where visual evidence of movement can be seen. Refer to the metadata for more specific information about the line attributes.

Seismic reflection data demonstrate there is a 3-km wide fault-cored anticline (fold) on the north-side of the trace of the Castle Mountain fault (Haeussler and others, 2000). The faults that core this fold are probably active and also constitute a seismic source. An aeromagnetic high is associated with uplifted basement in the core of the fold (Saltus and others, 2001), which can be used to deliniate the structure on a regional scale. The high parallels the Castle Mountain fault for a length of 65 km from the Susitna River to the Houston area, and it has a separate line code in the coverage.

Discussion of Point Coverages

The Detterman and others (1974) map had annotations on the aerial photographs indicating scarp height and various observations along the fault trace. The high and low elevations for these locations are reproduced in the point coverage cmfault_pnt. Refer to the metadata for more specific information about the point attributes.

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