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Laramide thrust faulting, Klondike Hills, southwestern New Mexico

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LARAMIDE THRUST FAULTING, KLONDIKE HILLS SOUTHWESTERN NEW MEXICO

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INTRODUCTION

The Klondike Hills (fig. 1) are at the north end of the Cedar Mountains approximately 50 km (30 mi) southwest of Deming. Basin-Range faulting during the Tertiary created the present mountains by uplift along range-marginal faults; internal structures within the Klondike Hills, however, are principally thrust faults of Laramide age.

The Klondike Hills are near the northern margin of the Cordilleran foldbelt of southwestern New Mexico (Corbitt and Woodward, 1973). The foldbelt trends west-northwest through the southwestern corner of New Mexico and is mainly characterized by low-angle thrust faults and subordinate closely compressed, overturned folds. The southern part of the Klondike Hills consists of a structurally complex thrust plate of Ordovician El Paso-Montoya and Silurian Fusselman carbonates overlying the Mississippian Keating Formation. South of the Klondike Hills, the Cedar Mountains (fig. 1) consist primarily of post-orogenic Tertiary volcanic rocks. However, one small exposure of prevolcanic rocks in the Cedar Mountains exposes Mississippian carbonates which have been thrust over Cretaceous conglomerates (Varnell, 1976).

Yielding on the thrusts was northward toward the foreland. The amount of displacement cannot be determined accurately, but may have been several kilometers. North-northeast yielding thrusts are present south and west of the Klondike Hills in the Apache Hills (Peterson, 1976), Sierra Rica Hills and Big Hatchet Mountains (Zeller, 1958), Hatchet Gap (Lasky, 1947), Little Hatchet Mountains (Zeller, 1970) and Brockman Hills (Corbitt and others, 1977); to the north in the Victoria Mountains (Kottlowski, *in* Griswold, 1961); and to the northeast in the Snake Hills and Florida Mountains (Corbitt, 1971; Corbitt and Woodward, 1973) (fig. 1).

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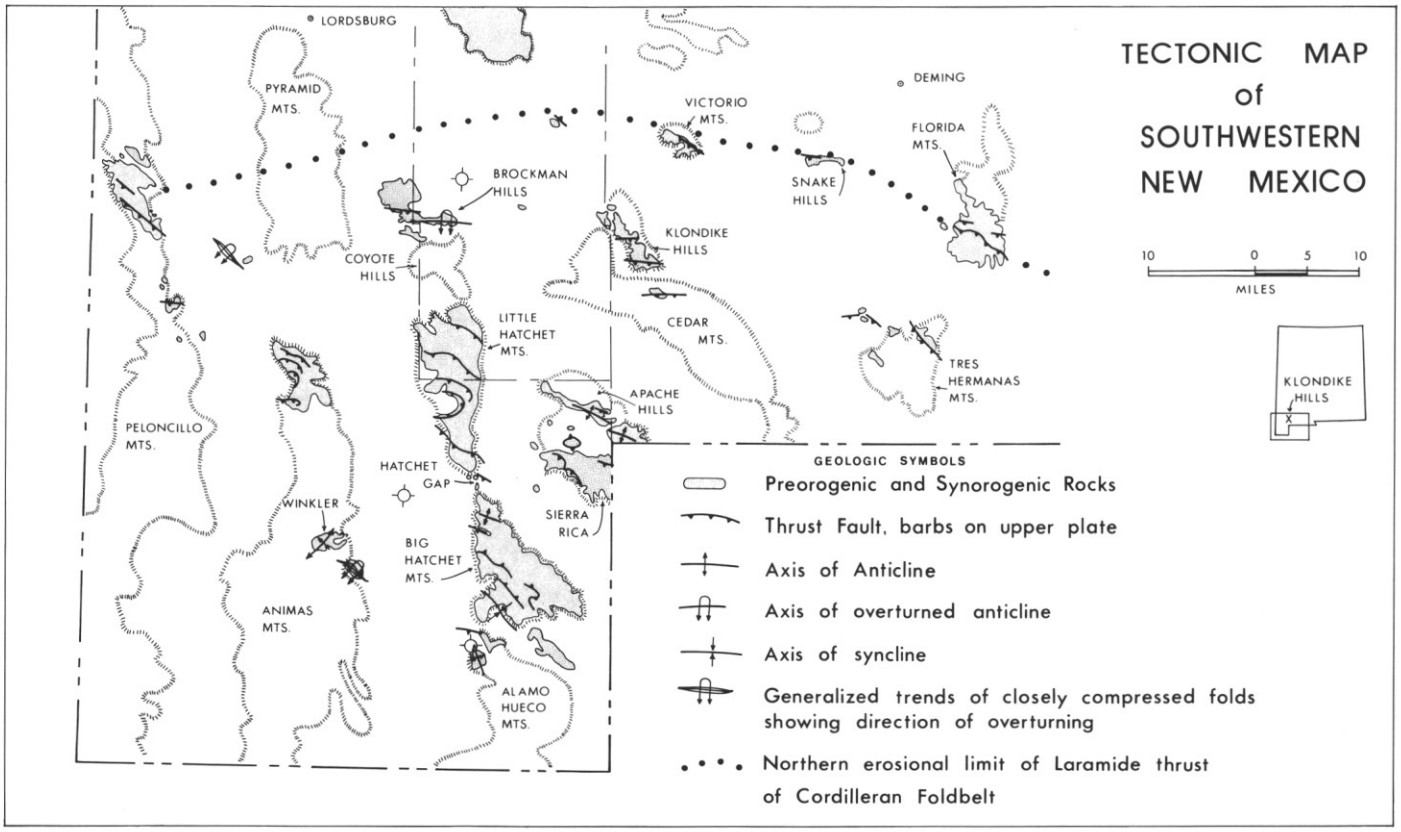


Figure 1. Index—tectonic map of southwestern New Mexico, including Klondike Hills area (modified from Corbitt and Woodward, 1973).

STRATIG RAPHY

Precambrian through Mississippian rocks are exposed in the Klondike Hills (fig. 2). Because of complex structure, thickness of units can only be estimated.

The Precambrian consists of three small exposures of granite and gneiss (fig. 2). The Cambrian Bliss Formation was not recognized in the map area.

The Lower Ordovician El Paso Formation is a light- to medium-gray, thin-bedded limestone with numerous thin, closely spaced, crinkled, tan- to brown-weathering argillaceous and silty layers. The overlying Montoya Group consists of four easily recognized formations which are very useful in recognizing low-angle thrust faults. The basal Cable Canyon Sandstone is 2-3 m (6-10 ft) thick and consists of quartzite and dolomitic sandstone. The overlying Upham Formation is a dark brown, coarsely crystalline, crinoidal, black-weathering dolomite. The Aleman Formation is a laminated to thin-bedded chert in a limestone or dolomite matrix. The Cutler Formation overlies the Aleman Formation and is a light to dark gray, medium- to thick-bedded dolomite.

The Silurian Fusselman dolomite is a tan- to dark-gray dolomite similar to the underlying Cutler Formation. Because of the difficulty of distinguishing between the two units, they were mapped together.

The Devonian Percha Shale is an olive-green fissile shale. The Lower Mississippian Keating Formation is the youngest Paleozoic unit exposed in the map area (fig. 2). It consists of light to dark gray, medium-bedded cherty limestone. The Mississippian and Pennsylvanian section exposed north of the map area has been described in detail by Armstrong (1970, p. 59).

STRUCTURE

The southern Klondike Hills consist of a structurally complex thrust plate of Ordovician El Paso-Montoya and Silurian Fusselman carbonates overlying Mississippian Keating Formation (fig. 2). South of Sheep Mountain (figs. 2, 3) in section 22, T. 26 S., R. 13 W., Keating is exposed beneath El Paso and Montoya carbonates in a window (figs. 4, 5). Percha Shale is exposed beneath Montoya 1 km south of the window in section 27, T. 26 S., R. 13 W. (fig. 2). No discernible outcrops are present immediately north of Sheep Mountain (figs. 2, 3). Float downslope from El Paso and Montoya outcrops consists almost entirely of Keating Formation, suggesting the presence of Keating bedrock at very shallow depth. A flat thrust fault is inferred in this area and to the northwest in sections 8 and 16, T. 26 S., R. 13 W. (fig. 2), between Keating and overlying El Paso-Montoya and Fusselman. The contact between El Paso and Keating in the NE'/ section 21, T. 26 S., R. 13 W., is much steeper and may be a younger normal fault (figs. 2, 6).

The structure of the lower plate of Keating appears to be relatively simple. The upper plate, however, has complex structure (fig. 2), recognized by elimination and repetition of the four formations in the Montoya Group along low-angle faults. In general the upper plate dips 0-30° to the southeast. Yielding

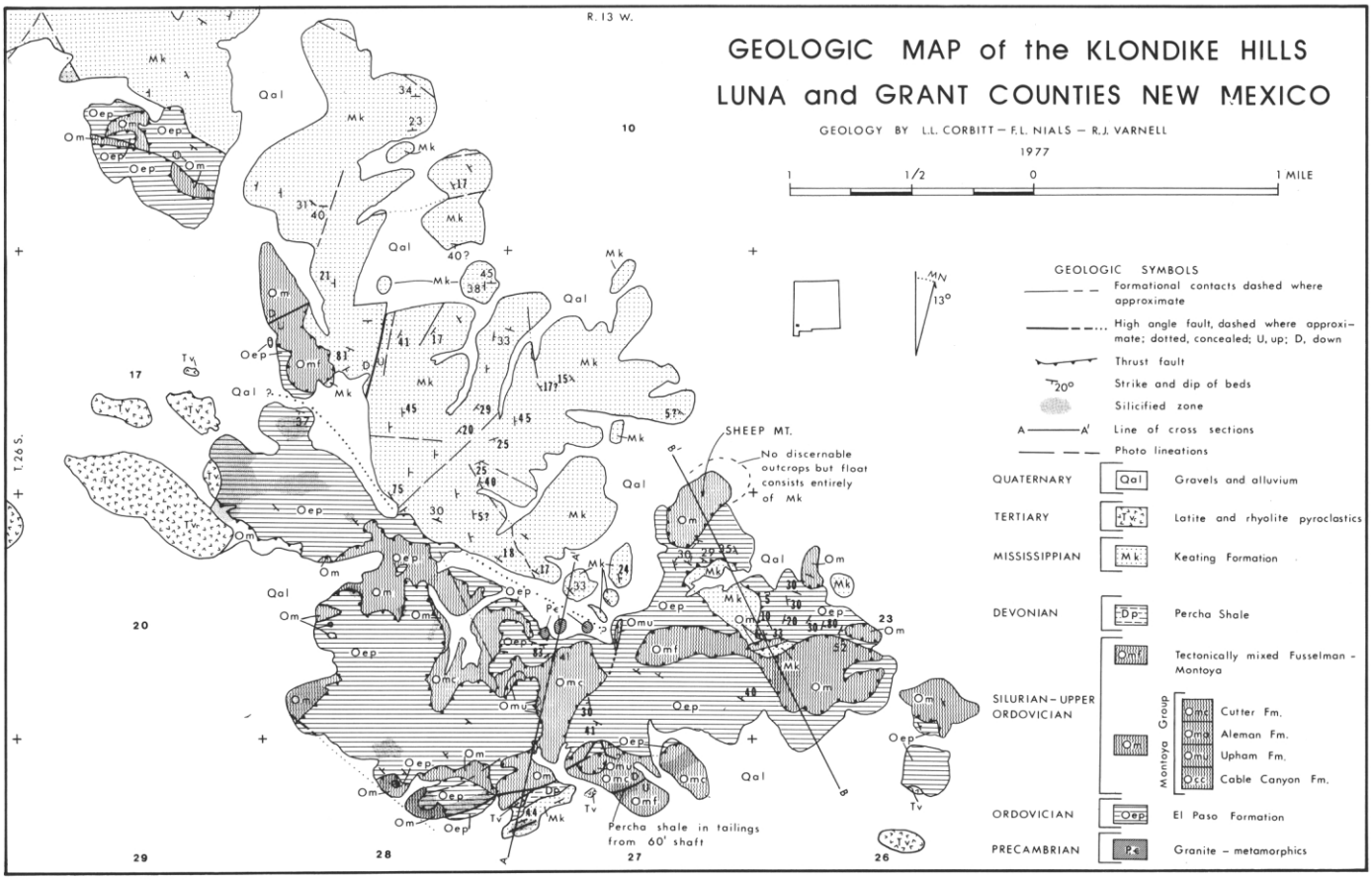


Figure 2. Geologic map of southern part of Klondike Hills.

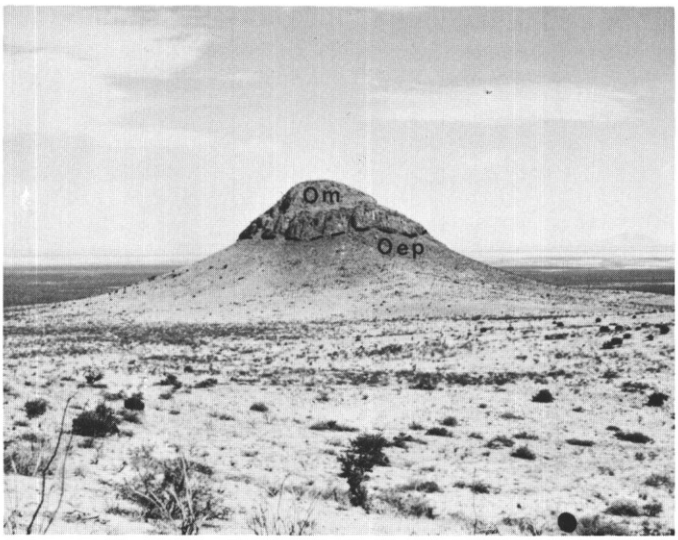


Figure 3. View to southwest of Sheep Mountain. Symbols as in Figure 2.

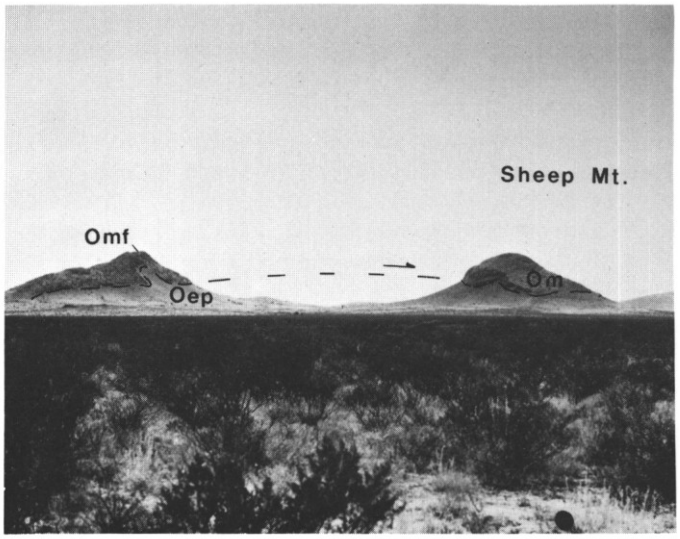


Figure 4. View to southwest of window exposing Mississippian Keating Formation beneath flat thrust plate of Ordovician El Paso Formation and Montoya Group. El Paso-Keating thrust contact not shown on photo. See Figure 5 for aerial view and Figure 6 for structure section. Symbols as in Figure 2.

on the thrusts was northward toward the foreland. The amount of displacement cannot be determined accurately, but may have been several kilometers.

Immediately south of the Klondike Hills in the Cedar Mountains (fig. 1), Mississippian carbonates have been thrust northward over Cretaceous conglomerates. Northeast-yielding thrusts with stratigraphic separations up to 7.5 km (25,000 ft) are reported in the nearby Apache Hills (Peterson, 1976), Sierra Rica (Zeller, 1958), Hatchet Gap (Lasky, 1947) and Brockman Hills (Corbitt and others, 1977) (fig. 1).

The Klondike Hills are located approximately 25 km (15 mi) northeast of the Little Hatchet Mountains (figs. 1), where Zeller (1970) mapped four major thrust faults that deform Cretaceous and early Tertiary strata. The direction of yielding along the thrusts was toward the east and northeast, and displacement was probably several kilometers (Zeller, 1970, p. 17). In the Brockman Hills (fig. 1), 25 km (15 mi) west of the Klondike Hills, the Permian-Pennsylvanian Horquilla Formation has been thrust to the north-northeast over andesite of the early Tertiary Hidalgo Formation (Corbitt and others, 1977). Minimum stratigraphic separation produced by the thrusting is approximately 7.5 km (25,000 ft). In the Victoria Mountains 15 km (10 mi) north of the Klondike Hills, Ordovician El Paso strata are thrust northward over Lower Cretaceous strata (Kottlowski, *in* Griswold, 1961). Similar thrusting is present in the Snake Hills and Florida Mountains (Corbitt, 1971; Corbitt and Woodward, 1973).

The Klondike Hills structures are a well-exposed, key part of the Laramide foldbelt in southwestern New Mexico, which illustrate the structural style of the foldbelt and correlate very well with the work by Drewes (1976) to the west in Arizona.

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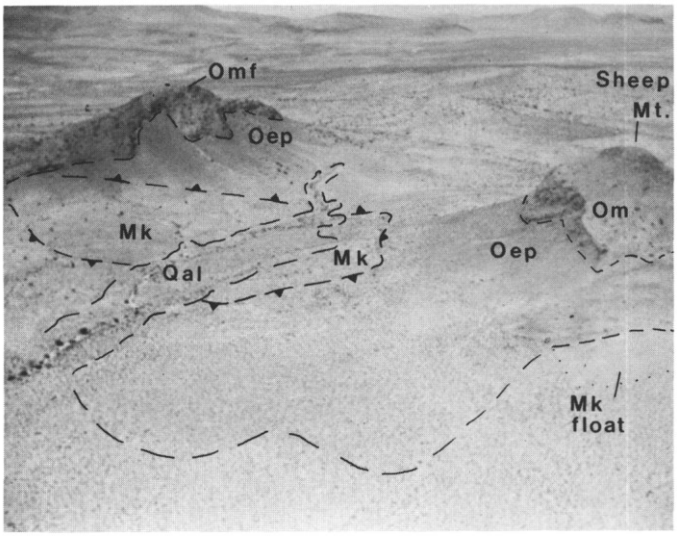


Figure 5. View to southwest into window shown in Figure 4. Symbols as in Figure 2.

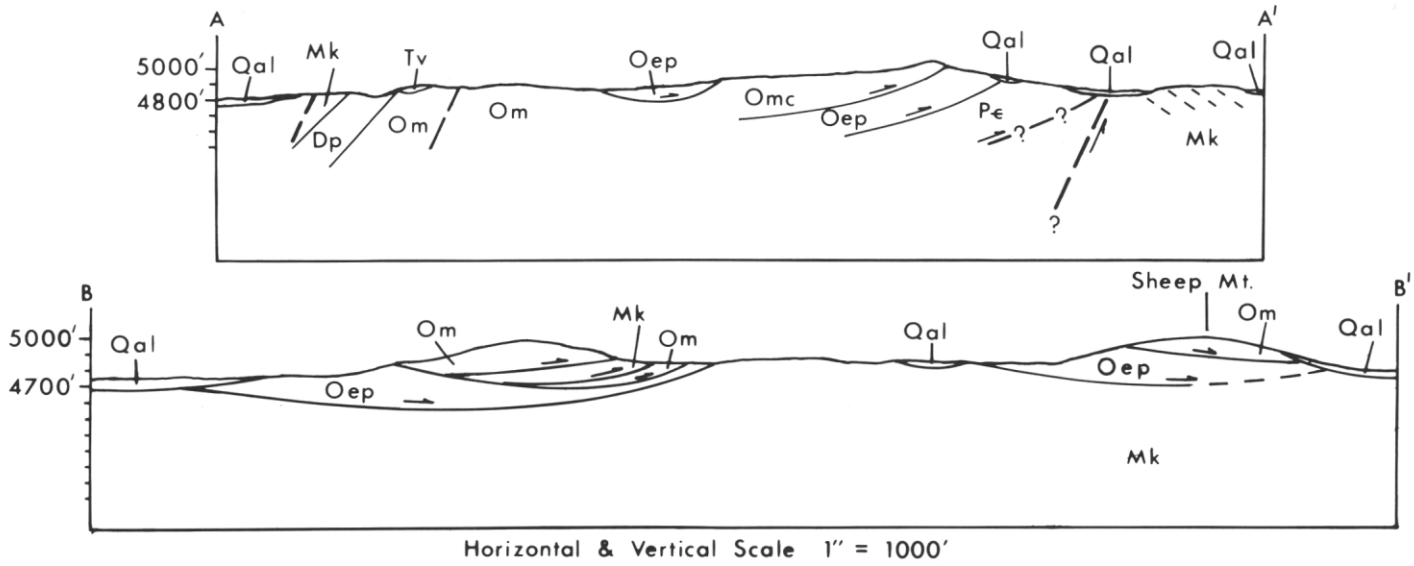


Figure 6. Structure sections of Klondike Hills. See Figure 2 for location and symbols.

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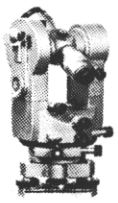
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