DESCRIPTION OF THE ONLY KNOWN FEN-PALSA IN THE CONTIGUOUS UNITED STATES

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ABSTRACT
An approximately 8-ha fen-palsa is located in the Beartooth Mountains, Wyoming, at an altitude of 2950 m. The graminoid palsa is raised 1 m above a surrounding Carex fen and subalpine wet meadow. It is underlain by permafrost at a depth of 38 to 46 cm. Thermokarst topography, including thaw depression lakes, characterize the palsa. This is the only known palsa in the 48 contiguous United States and represents the southernmost such occurrence in North America.

INTRODUCTION
Field observations of the Sawtooth Peatbeds (Johnson and Pfister, 1982), a subalpine fen-palsa, were made in summer 1982. The presence of a large, raised, graminoid peat deposit displaying thaw depression pools resulting from frost heaving, polygons formed by frost cracking, and surrounded by a Carex fen was believed to be highly unusual in Wyoming. Thus, this occurrence was investigated and analyzed. The purpose of this paper is to substantiate the uniqueness of Sawtooth fen-palsa to the lower 48 United States.

DESCRIPTION
Sawtooth fen-palsa is located in Shoshone National Forest, Beartooth Mountains, Wyoming (latitude 44°54'N, longitude 109°27'W) at an altitude of 2950 m. It is situated in the bottom of a broad, northwest-trending valley. The area was first described by Pierce (1961), who reported that the valley's shape suggested pre-Wisconsin ice scouring.

The fen-palsa is composed of an approximately 8-ha graminoid palsa surrounded by a Carex fen that grades into subalpine wet meadow (Figure 1). The entire fen-
palsa/wet-meadow complex encompasses approximately 16 ha and bears a striking resemblance to those reported from northern Canada (Figure 2).

The palsa is raised 1 to 2 m above the surrounding fen and wet meadow. Permafrost occurs at a depth of 38 to 46 cm below its surface (Pierce, 1961) and is believed to extend through the peat deposit into the underlying granite (Pierce, 1983, pers. comm.). Doming of the peat results from flotation of the less dense frozen peat and permafrost above the more dense wet peat of the surrounding fen (Zoltai, 1972).

The surface of the palsa appears to be exposed enough so as to be blown free of snow during the winter. It is characterized by uneven thermokarst topography, as described by Brown and Péwé (1973). Thaw depression pools present in the peat have resulted from frost heaving caused by thawing and refreezing of the active layer of the underlying permafrost. This freeze-thaw cycle has

FIGURE 1. General view of Sawtooth fen-palsa (44°54'N, 109°27'W; 2950 m a.s.l.). Note polygons present in peat in foreground.

FIGURE 2. Palsa located in the Northwest Territories, Canada (63°15'N, 132°02'W; 1475 m a.s.l.). Photo courtesy of G. P. Kershaw.
also caused cracking of the sides and edges of the palsa, resulting in active erosion of the peat into surrounding thaw depression pools (Figure 3). Polygons, formed as a result of frost cracking, and moss hummocks also characterize the surface of the palsa.

The palsa is practically devoid of vegetative cover. Scattered clumps of Deschampsia caespitosa and individuals of Rumex paucifolius were observed on the palsa in August 1982. Carex spp. and Antennaria lanata are also reported to occur (U.S. Forest Service, 1976, unpubl.). The surrounding fen is dominated by Carex scopulorum, C. praecursor, C. illota, and C. aquatilis. Deschampsia caespitosa dominates drier moss hummocks present in the fen. Large moss polsters, about 1 m in diameter, are devoid of vascular associates. Several moss species are present in the fen-palsa/wet-meadow complex; however, Sphagnum spp. are absent.

**SIGNIFICANCE**

Permafrost and associated permafrost landforms, including those characterizing Sawtooth fen-palsa, are common features within the continuous permafrost zone of Alaska, northern Canada (Kershaw and Gill, 1979), and northern Europe (Forsgren, 1968). Although both are also widespread within the discontinuous permafrost zone (Ives, 1974), the southernmost distribution of palsas is reported to occur in Canada at 53.0°N latitude (Railton and Sparling, 1973). This is approximately 1000 km north of Sawtooth fen-palsa. Within this zone, palsa occurrence is often associated with a particular combination of environmental conditions, including elevation, topography, aspect, slope, wind, water availability, vegetation, and snow accumulation patterns (Brown, 1980; Zoltai, 1972; Ives, 1974).

Sawtooth fen-palsa is the only known palsa in the 48 contiguous United States. Although isolated patches of permafrost occur throughout the Rocky Mountains as far south as Arizona (Mears, 1981; Good, 1964; Pierce, 1979; Love, 1982; Ives, 1973; Péwé, 1982), none is associated with palsas. Sawtooth fen-palsa represents the southernmost occurrence of a palsa in North America. It is extremely unique due to its size, southern location, and isolation from commonly occurring palsas in northern Canada and Alaska.

**ACKNOWLEDGMENTS**

The authors thank William Pierce, U.S. Geological Survey (retired), for his cooperation and for the use of his personal field notes, and G. P. Kershaw, University of Alberta, Edmonton, for allowing publication of his photograph.

![Figure 3. Active erosion into thaw depression pool.](image)
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Ms submitted July 1983