Chapter 4

Holocene Climate in the South-Central Interior of British Columbia

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Modeling the economic organization of prehistoric sites such as Keatley Creek is predicated on an accurate understanding of the local and regional environment, especially the types and extents of plant communities. While some idea of past plant communities and climates can be obtained from the types and distributions of plants that exist in the region around Keatley Creek today, significant changes have taken place at various times in the past. In order to accurately model the Keatley Creek economy during the last period of occupation (1,100–1,500 BP), it is necessary to determine to what extent the climate and plant communities were different at that time from today's environment. That is the goal of this chapter.

Recent geochemical investigations of ice cores from Greenland (O'Brian et al., 1995) and other climatic indicators (Stager and Mayewski, 1997) have emphasized that the Holocene (last 10,000 years) has experienced several abrupt climatic transitions. Some appear to be reorganizations of atmospheric circulation patterns that affected ecosystems around the world (Stager and Mayewski, 1997). The most dramatic of these abrupt climatic changes occurs between ~7,500–7,000 radiocarbon years BP (8,200–7,800 calendar years ago). This is significant for British Columbia, since Mathewes (1985) emphasized that peak early-Holocene warm and dry conditions ended around 7,500–7,000 radiocarbon years BP. The early Holocene xerothermic interval, which peaked in warmth and dryness between 9,000–8,000 BP (Clague and Mathewes, 1989; Clague et al., 1992) had a profound effect on vegetation (Mathewes, 1985; Hebda, 1995) and therefore probably also on animals and humans. This transition, just a few centuries before the Mazama ashfall at ~6,800 BP, should therefore be represented in the archeological record of the Lillooet area.

Since publication of four pollen diagrams in the southern Fraser River drainage by Mathewes and King (1989), little new work has appeared that bears directly on the vegetation and climate history of the Lillooet area. The recently published review by Hebda (1995), however, provides a good summary of available data on paleoenvironments in British Columbia, with an emphasis on the mid-Holocene interval (6,000 BP). In this review Hebda provides a new pollen diagram from "Pemberton Hill" lake, a palynological study site from the Interior Douglas-fir Zone near Kamloops, as well as summarizing interpretations of grassland vegetation history and climate for the southern interior.

Hebda identifies two major periods of change during the Holocene, the first at about 8,000 BP, when the warm and dry early Holocene begins to change to a warm but wetter period between 8,000–4,500 BP. During this interval, dry grasslands with abundant sage and few trees gave way to mesic grasslands with expanding populations of trees such as Douglas-fir and Ponderosa pine. The second major change was designated around 4,500 BP, when modern grassland distributions developed, and cooling to modern climatic conditions took place.

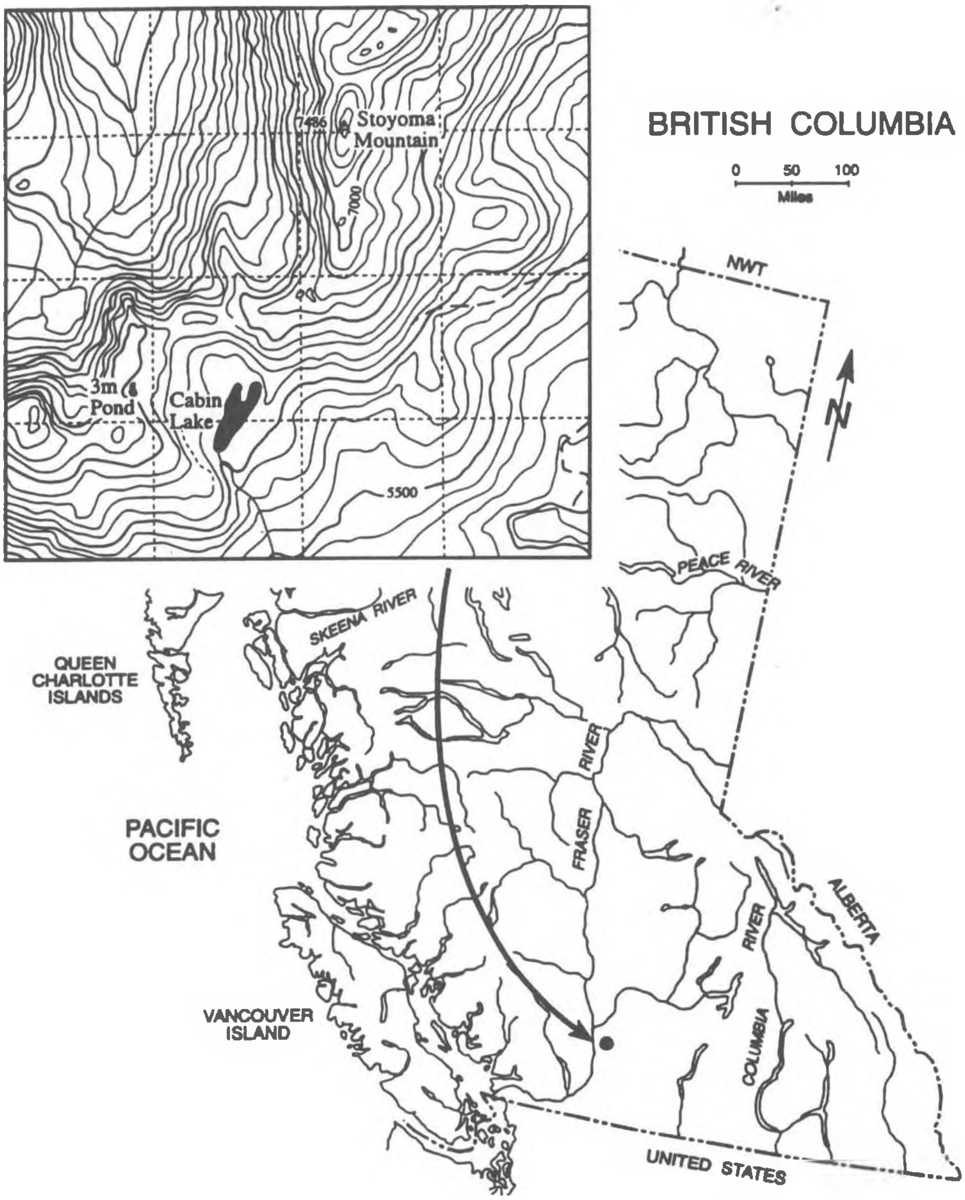

Figure 1. Map of British Columbia showing the Cabin Lake and Stoyoma Mountain sampling localities.

Hebda's (1995) conclusions differ somewhat from those of Mathewes and King (1989) who place the major post-Mazama periods of change at about 5,650 BP, during the early neoglacial period (Ryder and Thompson, 1986), and at about 2,000 BP, based on pollen and aquatic molluscs in Phair and Chilhil lakes near Lillooet.

New paleoecological investigation of lake sediments at Cabin Lake on Mount Stoyoma (Pellatt, 1996; Smith, 1997) also reveal significant changes in vegetation and climate in the southwestern interior of British Columbia since deglaciation. Mount Stoyoma is located in the northern Cascade Mountains (Fig. 1) and represents the typical subalpine environment for the southwest interior. A pollen diagram (Fig. 2) from Cabin Lake summarizes the Holocene vegetation changes in this area. Pollen, plant macrofossil, and chironomid (midge) head capsule analyses indicate five major changes in environmental conditions (Pellatt et al., 1995; Pellatt, 1996; Smith, 1998). These changes are summarized as follows:

1) Cold continental conditions during the late Pleistocene (>10,000 BP) supporting an open alpine tundra environment and cold-stenothermous chironomid population.

2) Warm and dry (xerothermic) conditions in the early Holocene (10,000 to 7,000 BP) supporting a non-analogous open spruce parkland and warm-adapted chironomids.
3) Relatively warm and moist (mesothermic) conditions in the mid-Holocene (7,000 to 4,800 BP) supporting a closed spruce forest and a mixture of warm and cold-adapted chironomids.
4) A transitional period of climatic deterioration in which temperature decreased from 4,800 to 3,200 BP, and in which the characteristics of the modern Engelmann Spruce Subalpine Fir (ESSF) forest began to be established.
5) Modern subalpine conditions established between 3,200 BP and present, with minimum Holocene temperature and relatively high precipitation occurring between 2,435 and ca. 1,700 BP. A cold-adapted chironomid community also becomes established at this time. The modern Engelmann Spruce Subalpine Fir forest around Cabin Lake appears to have been relatively stable for the last 1,700 years.

Paleovegetation and climate change at Cabin Lake corresponds well with changes observed elsewhere in the southern interior (Fig. 3), three phases of climate change have been noted. These periods are the early Holocene xerothermic period (10,000 to 7,000 BP), a period of climatic transition to modern conditions in the mid-Holocene (7,000 to 3,200 BP) with a warm/moist mesothermic phase occurring between 6,800 to 4,800 BP, and the establishment of modern climatic conditions after 3,200 BP. The climate change at ~3,000 BP corresponds well with neoglacial conditions identified throughout the Canadian Cordillera (Ryder and Thompson, 1986).

None of the available palynological studies in the southern Interior has so far been able to document environmental changes during the Little Ice Age, the period within the last millennium when many alpine glaciers re-advanced to their maximum positions (ca. 1300–1850 AD) since the end of the Pleistocene. Such advances have been well documented in the southern Rocky Mountains (Luckman et al., 1993) and elsewhere, and have been shown to affect vegetation distributions (Clague and Mathewes, 1996). Since peak cooling is generally attributed to a few centuries between about 1550–1850 AD, such an event is difficult to detect by the coarse sampling intervals used in standard regional pollen analytical investigations. Close-interval core-sampling and analyses of tree rings are two approaches that should be applied to high-elevation sites around Lillooet to determine if the Little Ice Age altered the vegetation in this area, and if it could have affected native subsistence, settlement, or migration patterns.

Cabin Lake, British Columbia

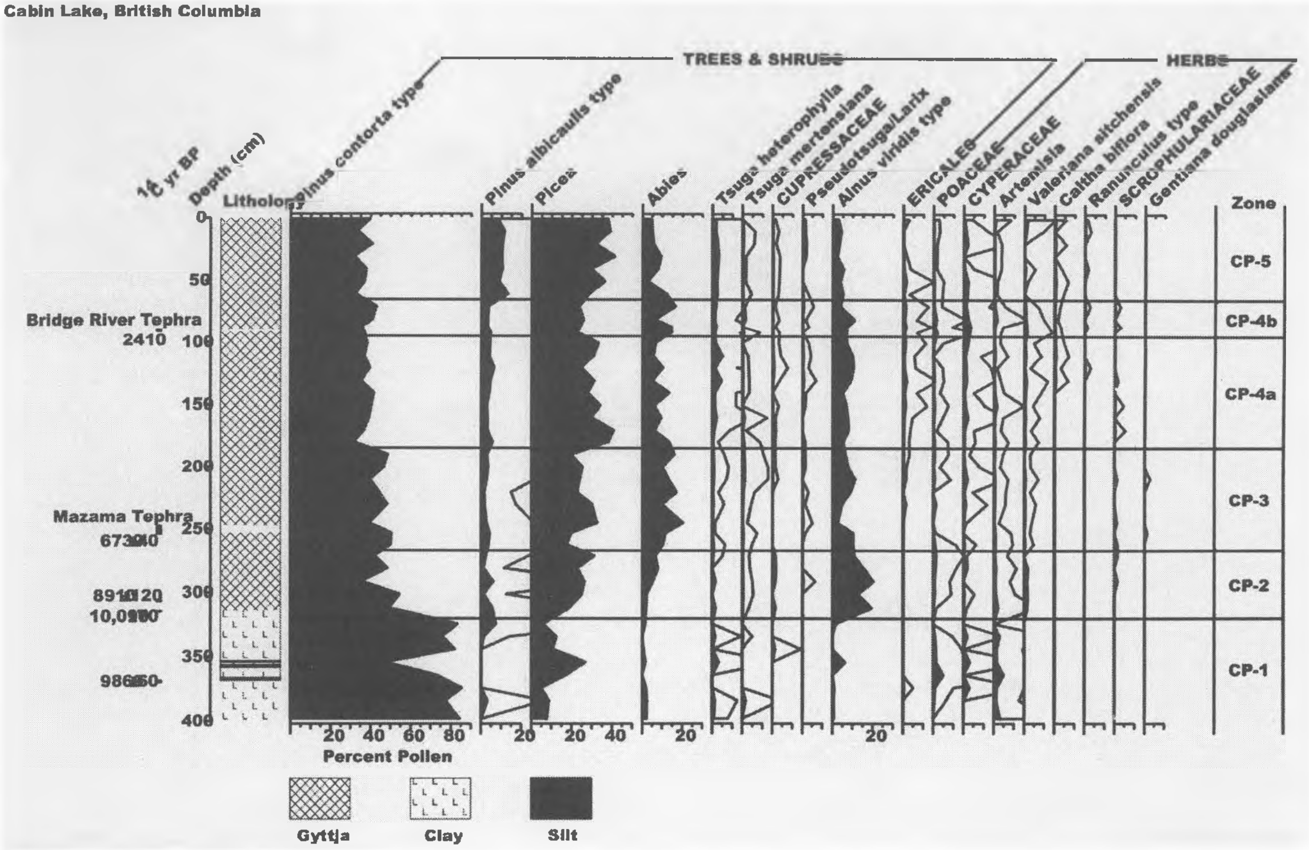

Figure 2. The pollen diagram and dates from Cabin Lake.

Archaebotanical investigation has been undertaken at sites near Lillooet, British Columbia. Recent palynological analysis was performed by R. Holloway on non-human coprolites recovered from Bridge River archaeological site EeRl 4 (ca. 1,100 BP) and by R. Vance on soil recovered under a dog skull from Housepit 7 at the Keatley Creek archaeological site (ca. 1,080 BP). The recovery of pollen from the coprolites was very low (Fig. 4), but the taxa recovered are present in paleoecological study sites from the Interior Douglas Fir (IDF) biogeoclimatic zone (Mathewes and King, 1989; Hebda, 1995). The presence of sedge (Cyperaceae), *Sparganium/Typha* pollen, and *Equisetum* spores in some of the coprolites is probably due to water ingestion by the animals. Due to the extremely low values of pollen in the coprolites no palaeoecological inferences can be made.

Similar to the coprolites, the pollen recovered from housepit soil at HP 7 (Keatley Creek) contains taxa common in the IDF (Fig. 5). There are exceptionally high levels of Chenopodiaceae and Polygonaceae pollen in the sample, suggesting bias due to differential pollen preservation in the pollen assemblage. Based on the pollen recovered from the coprolites and housepit soils, it appears that these archaeological remains may be useful in determining the presence of vegetation at a regional level, but caution must be used in making palaeoecological inferences from such biased pollen assemblages.

Another technique that should be tried in the Lillooet area is the analysis of pollen, plant macrofossils, and fossil insects preserved in packrat middens. Such studies have been shown to be very useful in arid and semi-arid areas in the American Southwest in reconstructing local vegetation and climate. Since middens are available in British Columbia (Hebda et al., 1990), they could contribute significantly to a multi-proxy approach to climate history.

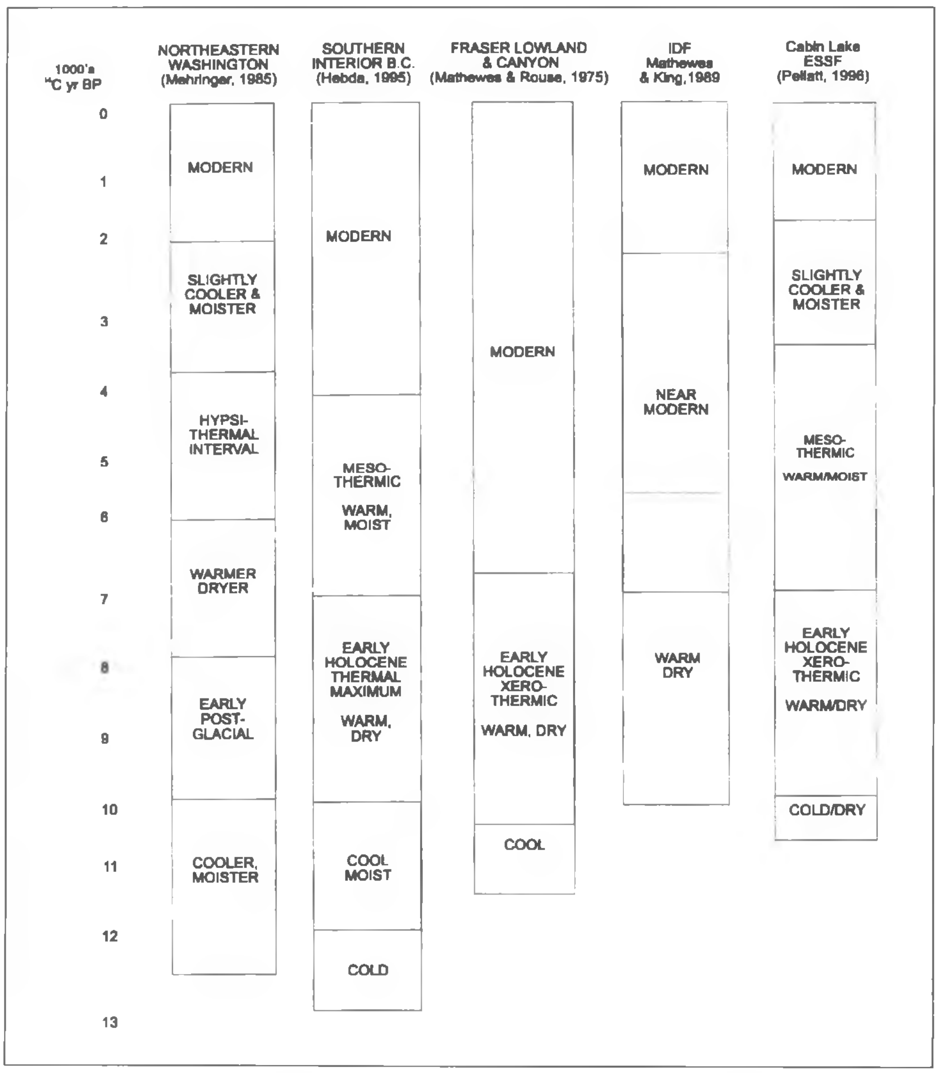

Figure 3. Regional interpretations of paleoclimates and vegetation changes since deglaciation in southern British Columbia.

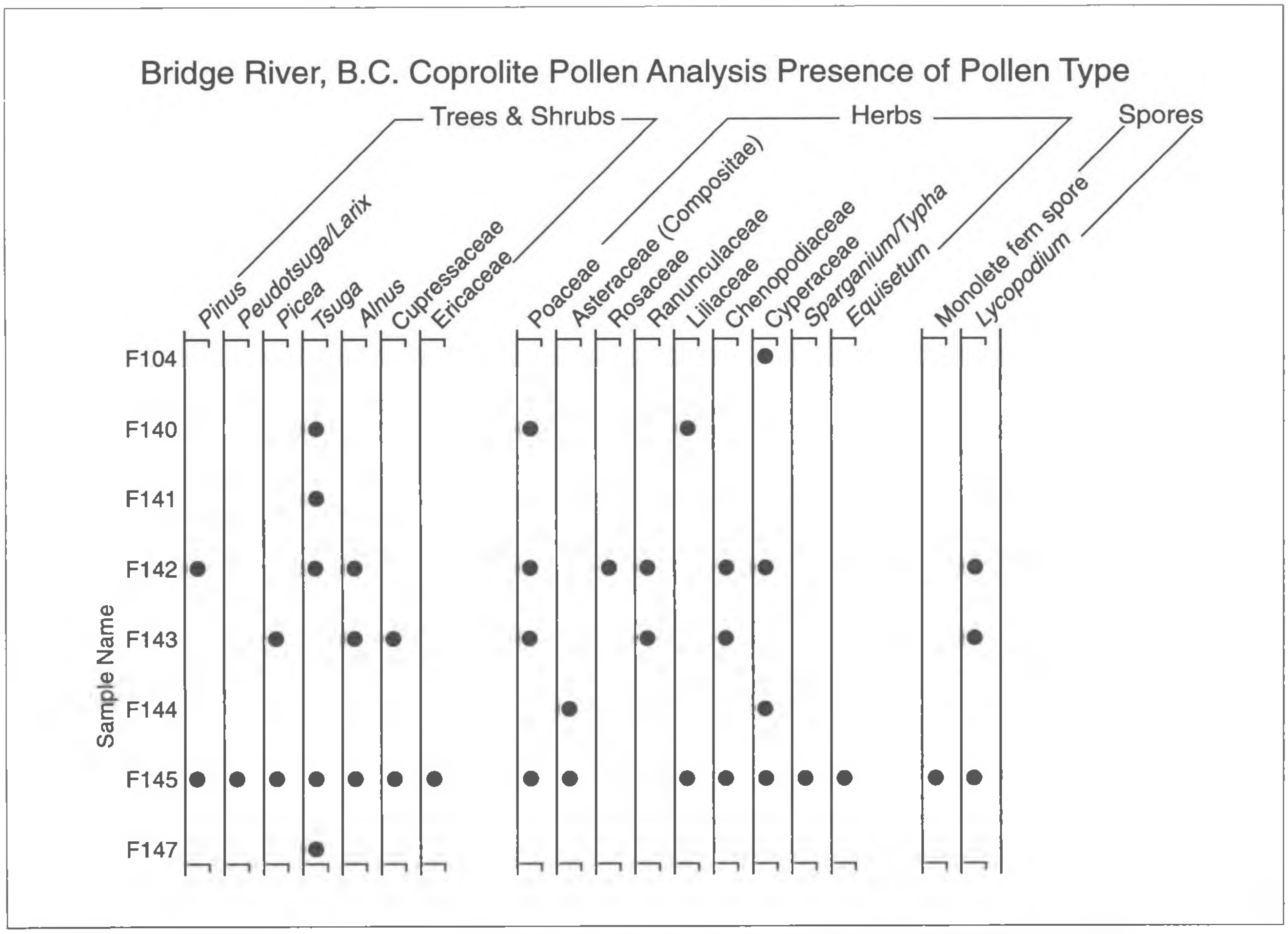

Figure 4. Pollen counts from Bridge River site dog coprolites analyzed by R. Holloway for Arnoud Stryd.

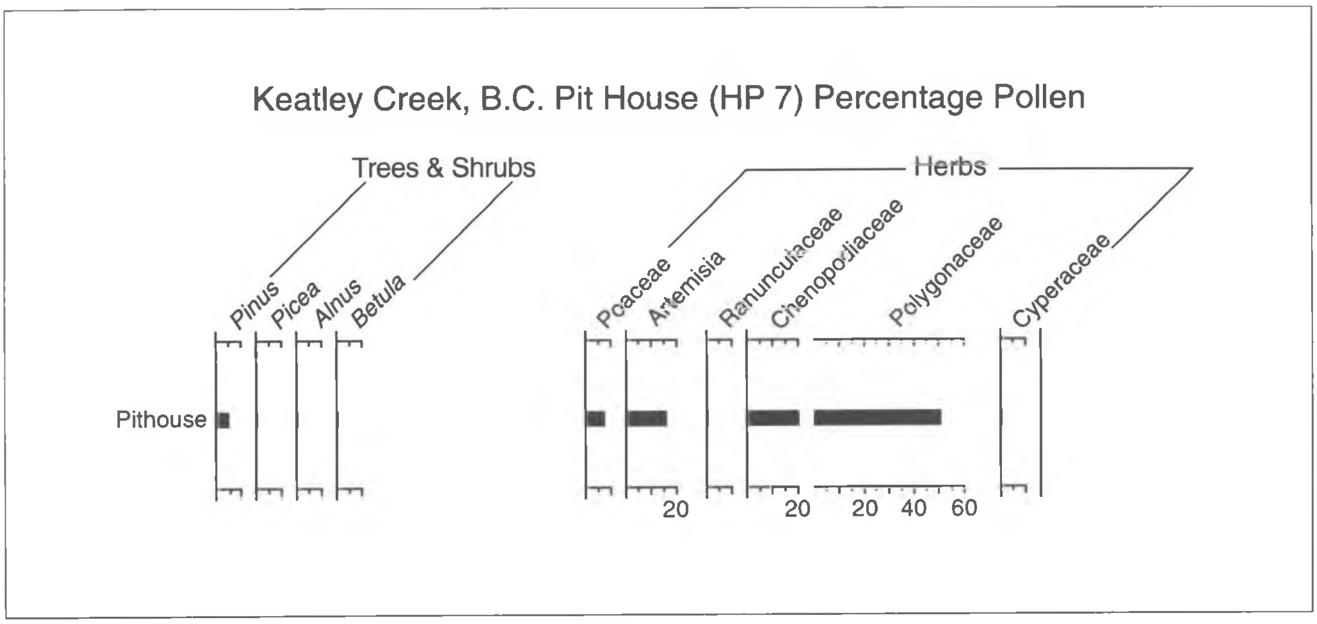

Figure 5. Pollen counts from floor sediments underlying a dog skull on the floor of HP 7 (analysis by R. Vance).

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