Forensic palynology and ethnobotany of *Salicornia* species (Chenopodiaceae) in northwest Canada and Alaska

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Abstract: Pollen grains from bodies of ancient people provide clues to their diet and domicile. To learn more about Kwädāy Dän Ts'ìnchí (Long Ago Person Found), who died on a British Columbia glacier 550 years ago, we studied the Chenopodiaceae pollen found in his stomach and robe. Environmental scanning electron microscopy was used to distinguish pollen of the native chenopod genera *Atriplex*, *Chenopodium*, *Eurotia*, *Suaeda*, and *Salicornia* (here including *Sarcocornia*). All chenopod pollen grains in one stomach sample were from *Salicornia* (Tourn.) L. (glasswort), which grows only in saline soils and has been used for food and medicine. Elders from the Champagne and Aishihik, Tagish, Gwitch'in, and Tlingit First Nations report their ethnobotanical and historical knowledge about inland and coastal *Salicornia* species. There is no common use for the small inland annual glasswort, *Salicornia rubra* A. Nelson, although other species were used for grain further south; however, Pacific Northwest coastal people have eaten the succulent perennial glasswort, *Salicornia perennis* Miller, since at least the 1880s. Pollen grains of this perennial salt marsh species are most similar to the chenopod pollen grains in the stomach of Kwädāy Dän Ts'ìnchí and suggest the ancient man's last meal came from the coast rather than from inland.

Key words: Chenopodiaceae, *Salicornia*, *Sarcocornia,* forensic palynology, frozen body, ethnobotany.

Résumé : Les grains de pollen trouvés sur les corps d'hommes anciens donnent des indices sur leur diète et leur habitat. Afin d'en apprendre plus à propos de Kwädāy Dän Ts'ìnchí (Personne ancienne retrouvée), qui est morte il y a 550 ans sur un glacier, en Colombie-Britannique, les auteurs ont étudié les pollens de Chenopodiaceae trouvés dans son estomac et sur sa tunique. Ils ont utilisé la microscopie environnementale électronique par balayage, pour distinguer les pollens des genres indigènes de Chenopodiaceae *Atriplex, Chenopodium, Eurotia, Sueda* et *Salicornia* (incluant ici *Sarcocornia*). Tous les grains de pollens de Chenopodiaceae trouvés dans un échantillon stomacal appartiennent au genre *Salicornia* (Tourn.) L. (corail), qui pousse seulement sur les sols salins, et a été utilisé comme aliment et comme médicament. Les aînés des premières nations de Champagne et Aishihik, Tagish Gwitch'in et Tlingit, relatent leur connaissance historique et ethnobotanique au sujet des espèces de *Salicornia* côtières et intérieures. Il n'y a pas d'utilisation courante pour le petit corail de l'intérieur, *Salicornia rubra* A. Nelson, bien que d'autres espèces aient été utilisées pour leurs graines, plus au sud; cependant, les peuples de la côte nord-ouest du Pacifique ont consommé le corail pérenne succulent, *Salicornia perennis* Miller, depuis au moins 1880. Les grains de pollen de cette espèce des marais salés sont très semblables aux grains de pollen de Chenopodiaceae trouvés dans l'estomac de Kwädāy Dän Ts'ínchì et suggèrent que le dernier repas de cet homme provenait de la côte plutôt que de l'intérieur.

Mots clés : Chenopodiaceae, *Salicornia, Sarcocornia,* palinologie médico-légale, corps congelé, ethnobotanique.

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Fig. 1. Map of the study region and the locations of important places mentioned in the text (modified from Dickson et al. 2004). The large dot marks the approximate site at which the Kwädāy Dän Ts'ìnchí frozen body was found. GB, Glacier Bay; H, Hoonah; K, Klukwan; LC, Lynn Canal; PI, Pleasant Island; T, Takhini salt flat.

Introduction

Study of pollen grains and other microscopic objects from the digestive tracts of ancient frozen bodies can reveal the composition of the persons' last meals, thereby allowing their final journey to be reconstructed and may establish their last place of residency (Dickson et al. 2003). The case of Kwädāy Dän Ts'ìnchí ("Long Ago Person Found" in the Southern Tutchone language) concerns a young aboriginal man who died on a glacier in northern British Columbia (Fig. 1) about 550 years ago (Beattie et al. 2000). The location of his remains, in rugged, high terrain (approx. 1600 m) away from any settlement, left the identity of this young man uncertain. Furthermore, the discovery site is close to 19th century historic travel routes that were aboriginal trading trails (Emmons and de Laguna 1991), suggesting that the man was a long distance traveller.

Light microscope studies of samples from the stomach and intestine of the Kwädāy Dän Ts'ìnchí frozen body (Hebda 2001; Beattie et al. 2000; Dickson et al. 2004) revealed small quantities of pollen, with a high proportion (21%–25%) of these being of the Chenopodiaceae (Goosefoot or chenopod) family. Light microscopy, however, does not allow definite identification of the pollen of many chenopod genera or species, which is needed to trace the geographic origin of the ingested pollen. Therefore, to identify the chenopod pollen to the genus level, ultra-high resolution studies were made of the pollen in one sample (T-30) from the stomach of Kwädāy Dän Ts'ìnchí using an environmental scanning electron microscope (ESEM) at the Bedford Institute of Oceanography (Dickson et al. 2002; Dickson et al. 2004). Seven chenopod grains were found in the ESEM sample, and all had features similar to SEM images (Mudie 1975) of pollen from *Salicornia pacifica* Standley (= *Salicornia virginica* auct., non L.; *Sarcocornia pacifica* (Standley) Scott) that grows in salt marshes of California and has been reported as far north as the Queen Charlotte Islands in northern British Columbia (Calder and Taylor 1968).

In this paper, we show how pollen of coastal and interior species of *Salicornia* from northwest Canada and Alaska can be distinguished from other chenopod pollen genera in this region, including *Atriplex, Chenopodium, Eurotia*, and *Suaeda*. We also report on some of the traditional knowledge about the use of *Salicornia* in southwestern Yukon and southern Alaska, and we review the uses reported for other

parts of North America and Europe. Finally, we discuss the contribution of this forensic palynological and ethnobotanical work to tracing the travels and possible identity of Kwädāy Dän Ts'ìnchí.

Background information

Local and regional setting

The frozen human remains and associated artifacts were found on and around a glacier margin in Tatshenshini-Alsek Park. The site is within the Tatshenshini River basin at about 1600 m elevation at the south end of the St. Elias Mountains (Fig. 1). The site is 15 km west of the Chilkat Pass, one of the few routes to the interior country from the coastal waterway known as Lynn Canal. Peaks around the glacier site reach elevations of ca. 1900–2000 m. Glacier-clad mountains further west are higher (ca. 2500–2700 m) and block access to the Pacific Ocean.

Though less than 70 km from the mild wet Pacific coastal rainforest, the site lies in the Sub-arctic Highlands Ecodivision of the Northern Boreal Mountain Ecoprovinces (Demarchi 1996). The site is near the border between the St. Elias Mountains and the Yukon Stikine Highlands Ecoregions that also extend into the adjacent southern Yukon. The Boreal Ecoprovince has severe, long winters and short summers. The vegetation comprises three zones: the Boreal White and Black Spruce Zone in valley bottoms and outwash plains; the Spruce – Willow – Birch Zone in high valleys and middle slopes; and an Alpine Tundra Zone covering middle and upper montane slopes.

The site is about 70 km southwest of the Tatshenshini-Alsek River junction and about 70 km upstream from Dry Bay on the coast. Closer sea access is through the Klehini and Chilkat River valleys, which are in or near the routes of the Chilkat Pass and the modern Haines Road. By this route, it is ca. 60 km from the discovery site to the ancient aboriginal village of Klukwan on the lower Chilkat River. From Klukwan, it is about 30 km to tidewater near Haines, Alaska.

Present-day regional distribution of chenopods

Distribution maps for Chenopodiaceae species (e.g., Hultén 1968; Cody 2000; Douglas et al. 2002; Flora of North America Editorial Committee 2004) and the Yukon collection in the Bruce Bennett Herbarium at Whitehorse show that in the Pacific Northwest, north of 58°N, Chenopodiaceae species are generally confined to the coastline or southern river valleys, and they do not occur at high altitudes near the glaciers. Although *Chenopodium* species in other parts of Canada produce abundant pollen (Bassett and Crompton 1982), there is no chenopod pollen in either the glacier ice or air pollen samples at Mt. Logan north of the site of the Long Ago Person Found discovery (Bourgeois 2002). Chenopod pollen is also absent in surface samples from the lakes of the St. Elias Mountains north of the study site (Birks 1977) and the White Pass area 50 km south of the site (Spear and Cwynar 1997). Chenopod pollen is also absent from snow and melt water samples collected at the site of the frozen body and analyzed by the first author (P.J. Mudie, unpublished data). It is therefore unlikely that the chenopod pollen entered the stomach of Kwädāy Dän Ts'ìnchí from either the air he breathed or the water that he drank while in the foothills or high mountain area, and it is most likely that this pollen was part of the food that he ate during the last few days of his life.

Forensic palynology

To confirm the tentative identification of the *Salicornia* pollen from the stomach sample of Kwädāy Dän Ts'ìnchí, the morphology of these pollen grains had to be compared with ESEM images of pollen from four other native chenopod genera that grow in the study region: *Atriplex* (orach), *Chenopodium* (goosefoot), *Eurotia* (winter fat), and *Suaeda* (sea blite). Detailed ESEM studies (Mudie et al., in preparation) were also made of pollen from the three *Salicornia* species in the region: the annual red glasswort (samphire) species that grows on salt or alkali flats in the southwest Yukon (*Salicornia rubra* A.Nels., formerly *Salicornia europaea* L. subsp. *rubra*), and two coastal species, *Salicornia perennis* Miller and *Salicornia depressa* Standley (= *Salicornia europaea* auct., non L., *Salicornia herbacea* auct., non L.) that grow around Glacier Bay and south of the Lynn Canal.

Other clues to the identity of Kwädāy Dän Ts'ìnchí

Determining the culture of this young man and who his people were has been a critical question since the discovery of his frozen remains in 1999. This was one of the primary motivations of the Champagne and Aishihik First Nations (CAFN) for allowing scientific studies on the human remains to proceed. CAFN is the aboriginal government in whose traditional territory the discovery was made; it has taken responsibility for ensuring that First Nations' values are honored in all matters related to the find.

The question is whether Kwädāy Dän Ts'ìnchí was a traveller from a coastal village such as Klukwan to the south or a village to the west on the Pacific coast, or was he from the Yukon interior to the northeast? Or was he a local resident, perhaps from a long lost fishing village on the nearby (11 km) Tatshenshini River? Tlingit peoples have occupied the coastal area since historic (contact) times (Emmons and de Laguna 1991; de Laguna 1972). The interior is home to the Southern Tutchone and Tagish people (McClellan 1975) whose languages both belong to the Athapaskan family. The ethnic distribution matter is particularly complex because at the time of first contact in 1890, the Tatshenshini was a bicultural area, home to both the Tlingit and Southern Tutchone people (McClellan 1975). It is not known though if this was also the situation at the time of the young man, about 550 years ago.

Clothing associated with the Long Ago Person Found included elements of both traditional interior culture (e.g., the Southern Tutchone of the Champagne and Aishihik people) and traditional coastal (e.g., Tlingit) culture. For example, his robe was made from skins of arctic ground squirrels (*Spermophilus* sp.; Mackie 2004; probably *Spermophilus parryii plesii* Richardson). This species, locally known as gopher, is common in the interior and at high altitudes in the coastal mountains of the Tatshenshini basin but does not live close to the seashore. Gophers were and still are commonly taken by the Southern Tutchone for food; traditionally their fur was used as clothing. On the other hand, the hat found near the frozen body (Young 2001 as cited in Pringle 2002)

was made from roots of Sitka spruce (*Picea sitchensis* (Bong.) Carr) that is a coastal tree found inland only as far as the Tatshenshini–Alsek confluence (Hosie 1975). Microscopy studies of samples from the hat crown and brim were identified as "a *Picea* species, likely *P. sitchensis* (Sitka spruce) because of the cross sectional appearance of the ray cells in the tangential plane" (Young 2001). The hat was also determined to be Tlingit in both style and construction method (Bernick 2001 as cited in Pringle 2002), and it is stylistically similar to a hat in a 19th century sketch of a Tatshenshini basin resident (Glave 1890, p. 352). It is also possible that the garments were trade items and therefore may not be direct clues to the cultural identity or place of origin of the Long Ago Person Found.

More direct clues to his identity come from his dietary history, as revealed by the various types of plant and animal remains in his digestive tract and found on his fur robe (Dickson et al. 2004). Food normally remains in the stomach only 3–4 h, and digested food in the intestine is not usually more than about 3 d old. Pollen of the coastal Western hemlock (*Tsuga heterophylla* (Raf.) Sarg.) was found in his stomach and on his robe. These pollen grains, however, are adapted to wind transport and are often blown over very long distances, which is evident from their presence in ice and melt water samples at and below the site of the frozen body. Their association with Kwädāy Dän Ts'ìnchí therefore does not definitely indicate that the young man came from the coast. On the other hand, a leaf fragment from a Mountain hemlock (*Tsuga mertensiana* (Bong.) Carr) and a fruit of the coastal herb Mountain sweet-cicely (*Osmorhiza berteroi* DC) found on the robe (Dickson et al. 2004) strongly suggest a coastal source.

The Long Ago Person Found was carrying pieces of chum salmon, which today is found only in the lowermost reaches of the Tatshenshini basin (Dickson et al. 2004). When dried, however, the fish can be stored for a long time, and in this state it is easily transported; therefore, this line of evidence is of limited value. However, fragments of marine shellfish, probably crab, were present in his gut, indicating that his last meal had been coastal food. Stable isotope data from his bone, muscle, and hair also suggest that he spent much time on the coast but had recently been inland (Dickson et al. 2004). Other scientific studies, such as the genetic relationship of Kwädāy Dän Ts'ìnchí to modern aboriginal communities (Monsalve et al. 2002) and the analysis of other material culture items he carried, are also ongoing. These studies will also provide clues to his identity and place of origin, in addition to contents of his stomach and intestine, that may show the direction of his travels in the hours and days immediately prior to his death.

If the chenopod pollen from the stomach sample could be identified to species level, it would provide an important clue to support the other lines of evidence about the place from which the young man began his last journey. Several genera of chenopods are known to be traditional food plants in other parts of North America, including coastal species of *Salicornia*, and the seeds or roots of *Atriplex, Suaeda*, and *Chenopodium* (Glen et al. 1998; Moerman 1998; Balls 1962), although there are few previously published reports of their use by aboriginal people in the Yukon or southern Alaska (Olson and Thilenius 1993; Pojar and Mackinnon 1994; Kari 1995). In this paper, we will document some of the ethnobotanical knowledge regarding traditional and historical uses of *Salicornia* and its close relatives (e.g., *Atriplex* and *Suaeda*) that may have been used by the Long Ago Person Found.

Materials and methods

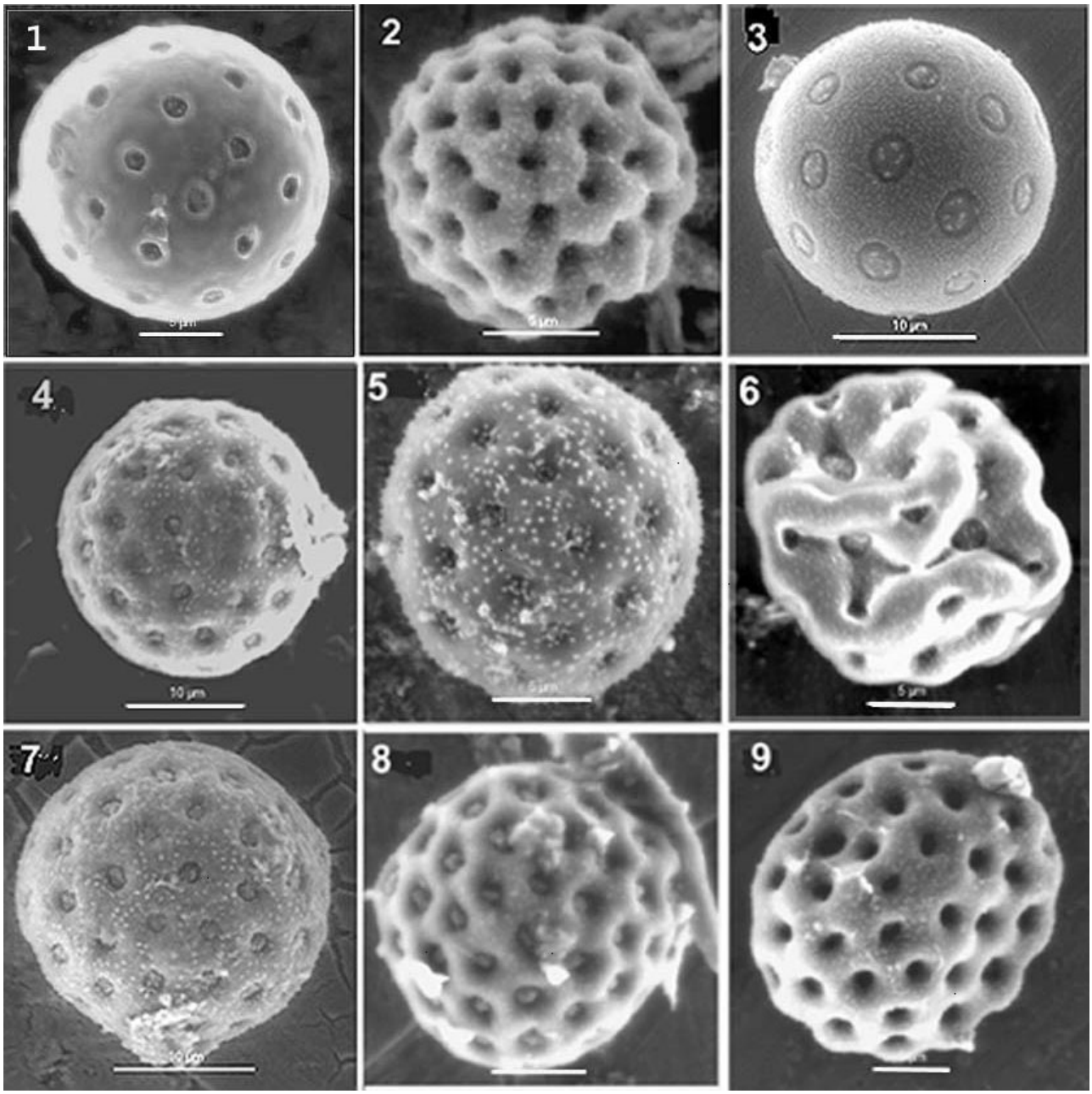
In August 2002, pollen of *Salicornia perennis* and *Suaeda calceoliformis* (Hooker) Moquin-Tandon (= *Suaeda maritima* (L.) Dumortier var. *americana* (Pers.) B. Boivin) was collected from coastal salt marshes at Juneau, Hoonah, Pleasant Island, and Gustavus, near Glacier Bay, Alaska. Pollen of *Atriplex alaskensis* S.Wats. was also obtained from plants growing at the driftwood line above the salt marsh at Pleasant Island. Pollen of the inland *Salicornia rubra* (= *Salicornia europaea* subsp. *rubra*) was collected from a salt flat near the Takhini River Bridge west of Whitehorse, Yukon (Fig. 1). Pollen of *Eurotia lanata* (Pursh.) Moq. and *Chenopodium dessicatum* A. Nelson, both of which occur sparsely in the southern Yukon today, was obtained from preserved material in sheets of the Bruce Bennett herbarium. Fresh pollen of *Salicornia europaea* L. was collected in salt marshes of Nova Scotia in September 2003.

All the pollen samples were preserved in ethanol. For the ESEM studies, the pollen was first rehydrated by warming in double-distilled (Super-Q) water and then washed several times by centrifuging and decanting. A subsample of the pollen was suspended in a drop of distilled water, mounted on an aluminum SEM stub, and air dried in a fume hood before coating with gold–palladium. The coated stubs were scanned with 17 KeV and a magnification of × 500. Ten to 15 grains of each species were imaged at magnifications of approximately × 5000 and × 13 000.

Measurements of the pollen grains and pore sizes, and counts of pollen pore numbers were made from prints of the digitized ESEM images captured either by polaroid camera or by digital photography. For the first five images of each species, the number of pores per grain was calculated in two ways: (1) Counting the number of pores seen on the imaged surface and multiplying by 2 (Campbell 1992); and (2) measuring the ratio of pore distance to grain diameter for three pairs of pores and estimating the pore numbers from the nomogram of Campbell (1992), which provides a more accurate estimate of pores on a spherical microfossil than the original method of McAndrews and Swanson (1967). If the pore number estimates obtained by the two methods agreed within 10%–15% (the limits of measurement error), the count was continued with the quicker method 2, using only one measure of pore distance per grain. If the estimates differed by more than 15%, then only method 1 was used to obtain the pore number, using traced drawings of the grains to keep track of the pore counts on each hemisphere.

Most of the consultations about traditional uses of *Salicornia* were made during August 2002 at the homes of First Nations Elders in either Haines Junction, Yukon, or Whitehorse, Yukon, and in the home of the Native American Elders at Klukwan, southeast Alaska. Mrs. Ruth Peterson-Welsh kindly drove to Whitehorse from Tagish, Yukon, for

Plate 1. ESEM images of pollen from chenopod genera that may have been in the study area 550 years ago. **Fig. 1.** *Chenopodium dessicatum* pollen from herbarium specimen 01-087 of Bruce Bennett, Whitehorse, Yukon, collected on the Takhini salt flats. Scale bar = 5 µm. **Fig. 2.** Pollen of a large *Atriplex* (*A.* cf. *alaskensis* S. Wats.) growing at the storm tide line, Pleasant Island, Alaska. Scale bar = 5 µm. **Fig. 3.** *Eurotia lanata* pollen from herbarium specimen 01435 of Bruce Bennett, Whitehorse, Yukon, collected on Sims River Delta, Yukon. Scale bar = 10 µm. **Fig. 4.** Chenopod pollen grain 5 from the stomach of the Kwädāy Dän Ts'ìnchí frozen body. Scale bar = 10 µm. **Fig. 5.** *Suaeda calceoliformis* pollen grain from sample FVS 4, Swanson Bay, Point Couverden, southeast Alaska. Scale bar = 5 µm. **Fig. 6.** *Salicornia rubra* pollen from Takhini alkaline salt flats, Yukon, Canada. Scale bar = 5 µm. **Fig. 7.** Chenopod pollen grain 9 from the stomach of the Kwädāy Dän Ts'ìnchí frozen body. Scale bar = 10 µm. **Fig. 8.** *Salicornia perennis* pollen grain from a tidal salt marsh near Hoonah, Alaska. Scale bar = 5 µm. **Fig. 9.** *Salicornia herbacea (Salicornia europaea* subsp. *europaea)* from herbarium specimen 4204, University of Glasgow, collected on the shore of Beauly Firth, Scotland. Scale bar = 5 µm.



an interview. All of the women spoke fluent English. Photographs and live specimens of *Salicornia rubra* and (or) *Salicornia perennis* were used as a discussion point. No mechanical recording devices were used during the meetings and all notes made by the first author (P.J.M.) have been corrected and updated by the co-authors. Judith Brakel interviewed Mrs. Emily Williams, who formerly lived in Hoonah, Alaska, during a visit to her home in Gustavus in

Table 1. Morphological characters of native Chenopodiaceae in the northwest Pacific region and from stomach sample KDT-30 of Long Ago Person Found.

Taxon	Grain diameter	No. of pores	Pore diameter	Surface ornamentation	Pore ornamentation	Pore annulus/margin
Chenopodium dessicatum	17.6 (16–20)	60–72	1.6 (1.4–1.8)	Smooth or punctate	4–5 granules	None/<0.4
Eurotia lanata	20.5 (19–23)	34 (30–40)	2.1 (1.5–3.8)	Scabrate	4–7 cones	None
Suaeda maritima[a]	24.5 (21–28)	70–140	2.4 (1.5–38)	Micrograna	5–6 granules	None
Suaeda calceoliformis[a]	25.0 (22–28)	95–170	2.0 (1.5–2.5)	Micrograna	5–6 granules	None
Suaeda calceoliformis[b]	17.0 (16–18)	54 (50–58)	1.1 (0.8–1.3)	Micrograna and microspines	7–10 granules or stellae	Low
Atriplex alaskensis	14.9 (13–15)	77 (64–84)	0.9 (0.7–1.1)	Micrograna	0–4 granules	High
Salicornia pacifica	15.2 (14–16)	95 (86–120)	1.1 (1.0–1.2)	Micrograna	1–3 cones	High
Salicornia perennis	17.6 (16–19)	88 (72 –104)	1.3 (1.1–1.6)	Micrograna	0–4 granules	High
Salicornia rubra	19.6 (18–23)	45 (37–55)	1.8 (1.4–2.3)	Micrograna	0–5 granules	High
Salicornia europaea	20.8 (20–22)	62 (54–68)	1.8 (1.7–2.2)	Micrograna and microspines	0–12 spinules	Low
KDT-30 chenopod grains	22.0 (20–23)	70 (68–72)	1.4 (1.3–1.6)	Micrograna	3–4 granules	High

Note: Means and ranges are in micrometres.
[a]From Bassett and Crompton (1978).
[b]Alaskan pollen in this study.

late August 2002 and by follow-up telephone conversations in 2003.

Results

Pollen morphology

The ESEM micrographs (Pl. 1, Figs 1–9) of the main native chenopod pollen genera in the Pacific Northwest show that the genera are distinguished by a combination of differences in grain size, the number and size of the pores, and by their pore morphology and ornamentation. Statistical details of grain size variations will be reported in detail elsewhere (Mudie et al., in preparation) but are summarized here in Table 1.

Pollen grains of *Chenopodium dessicatum* (Pl. 1, Fig. 1), one of three native *Chenopodium* species that may have been present in the region more 400 years ago (Hultén 1968; Cody 2000), are easily distinguished by their smooth surface lacking microgranules, relatively shallow pore pits with an irregular outline, and marginate pores, each being rimmed by a thin, low (approx. 0.1 μm) membrane. The pore pits are ornamented by 4–5 microgranules and are similar to the grains of *Chenopodium album* L. and other introduced *Chenopodium* species illustrated by Bassett et al. (1978). Winter fat (*Eurotia lanata)* pollen grains (Pl. 1, Fig. 3) are also easily distinguished by their low number of pores (less than 60), relatively large pores (up to 4 μm in diameter), densely scabrate ektexine, and presence of 4–5 conical spinules on the pore plugs. Similar features are evident in SEM images of winter fat pollen shown by Bassett et al. (1978).

Most of the other genera have pore numbers greater than 60, broadly annulate pores, and microgranulate or microechinate surface ornamentation. The pollen grains of the beach orach (*Atriplex* cf. *alaskensis*) are similar to *Chenopodium dessicatum* (Pl. 1, Fig. 2), but they have much smaller pores (<1 μm) without marginae, densely microechinate walls and deeply sunken ovate to round pore pits, with sparse or no pore plug ornament. *Salicornia* grains are easily distinguished by their well-rounded, annulate pores that are about 1–2 μm in diameter and have nearly vertical sides as if stamped out by small cookie-cutters. The *Salicornia* pollen grains are also <23 μm in diameter and have fine surface ornamentation and a low number of microgranules on the pore plugs (see Pl. 1, Figs. 4, 6, 7–9). Pollen grains of *Suaeda calceoliformis* (Pl. 1, Fig. 5) are similar to *Salicornia* in size but they have a low pore number (< 60) and small pores (approx. 1 μm) with low rims that are gently sloping in contrast to the steep-sided *Salicornia* pore areas. The pore plugs in *Suaeda calceoliformis* grains also differ from *Salicornia* in having both microechinate and stellate ornamentation. Pollen of other Canadian *Suaeda* species (Bassett and Crompton 1978) have larger grains (>24 μm) and densely granulate pore plugs.

Plate 1 also shows the features that distinguish the pollen grains of coastal *Salicornia* species from the inland species, *Salicornia rubra*. The inland annual species from the Takhini, Yukon, saltflat, *Salicornia rubra* (Pl. 1, Fig. 6), has a relatively low pore number (37–55) and large pores (1.8–2.0 μm) with microgranulate pore plugs, and most of the grains are folded or crumpled. Pollen of the related annual coastal species, *Salicornia europaea*, is similar in size and pore diameter, but most of the grains are well rounded, the pore number is higher (54–68), and the ornamentation includes microspinules in addition to micrograna (Pl. 1, Fig. 9). The perennial coastal species, *Salicornia perennis* has smaller grains (16–19 μm) with abundant (72–104) small pores, each with a diameter of about 1.3 μm (Pl. 1, Fig. 8). Pollen of the related coastal perennial *Salicornia pacifica* from southern California (Mudie 1975) is similar, but it is smaller and has more pores (see Table 1).

Interviews

Rosalie Washington and Mary Shadow

Mrs. Washington and Mrs. Shadow are Champagne and Aishihik First Nations Elders, who live in Haines Junction, Yukon, and are authorities on traditional uses of local wild plants. They are not familiar with any uses for the red glass-

wort (*Salicornia rubra*), although Mrs. Shadow has seen it growing at Takhini, Yukon, and Mrs. Washington knew that it grew around salt licks on the Aishihik Road. Both of these Elders think that use of the plant is not known to most of the Champagne and Aishihik First Nations people. Mrs. Washington, however, had talked to Mr. Fred Brown of Canyon Creek, Yukon, who thought that red glasswort might have been used for medicine a long time ago.

Clara Schinkel

Mrs. Schinkel is a Tagish Elder, originally from Tagish, later living in Carcross, Yukon, and now in Whitehorse, where she teaches ethnobotany. She recognised the red glasswort as being from brine areas where animals come to get salt. It is not known as a Tagish woman's plant, but it could a man's plant, or a forbidden plant used only by medicine men (Shaman or Indian doctor). Mrs. Schinkel thinks that the red glasswort could be a powerful medicine. She also notes that grass and grasslike weeds are only eaten as starvation or special diet food, so that the presence of *Salicornia* pollen in the stomach of the Kwädāy Dän Ts'ìnchí frozen body may mark the end of a spiritual journey that was undertaken before the young man died on the glacier.

Ruth Peterson-Welsh

Mrs. Welsh is a Gwich'in Elder well known for her knowledge of Gwich'in ethnobotany (e.g., Andre and Fehr 2001; Andre et al. 2003). She is originally from Fort McPherson, Northwest Territories, on the Mackenzie River and presently lives at Tagish, near Whitehorse, where she has become familiar with the local plant uses. Mrs. Welsh does not know the red glasswort because it does not grow in the areas where she has lived and worked. On seeing and tasting the succulent plant, however, she commented that it might be a useful food for travel because of its high water and salt content. Alternatively, she thought that when it was dried, the salts might have a medicinal value. She took home some plants of *Salicornia rubra* to experiment with them as food or medicine.

Margaret Stevens

Mrs. Stevens is a Tlingit Elder who lives in Klukwan, Alaska, on the Chilkat River, about 30 km upstream from Haines, Alaska. Her 82-year old husband, George, also kindly consented to be present at the meeting, which was attended by an interpreter, Mrs. Suzanne Vuillet-Smith, of Haines. Mr. Stevens is an authority on the history of the Tlingit settlement at Klukwan and he recounted how it was first settled in the 13th century by people from Sitka, Alaska, who paddled and poled their canoes up the Chilkat River to Mile 18/19, Haines Highway, where they went ashore and marked "klukw" (= people) and "an" (= country) with mounds of sand and gravel. Mr. and Mrs. Stevens did not know *Salicornia rubra,* but Mrs. Stevens knew of a large green succulent plant like *Salicornia perennis* that grew at Mud Bay, Alaska, near Haines. She did not know of a use for this plant, however, and she suggested that we consult Elders in Sitka. Mrs. Stevens was very familiar with the type of spruce root hat found with the Kwädāy Dän Ts'ìnchí body, and she showed us a hat that she was making using roots of Sitka spruce.

Emily Williams (Sti Shaás)

Mrs. Williams (deceased April 2004 at Juneau, Alaska) was a Tlingit Elder of the Kiksadi clan, who was born in Sitka in 1928, and inherited Tlingit clan membership from her mother's side. Her father was of the Teikweidi Bear Clan from the Ketchikan area and he did a lot of traditional food gathering, as well as raising root vegetables in a garden at his summer camp. He died when she was 12 years old and Mrs. Williams was mainly raised by her grandmother who taught her many traditional Tlingit ways, especially those pertaining to food. Her husband, Father Michael Williams, was also Tlingit and he was raised in Hoonah, Alaska, by his grandparents, who taught him much about traditional Tlingit culture. After her marriage, Mrs. Williams lived in Hoonah where she was taught many ways of preparing and preserving native foods. Mrs.Williams spoke both Tlingit and English.

Mrs. Williams and her husband travelled to many towns and villages in southeast Alaska as part of Father Michael's work as a priest, and they were always interested in the various foods derived from local sources. Emily found that there is considerable difference from one community to the next because of variability in food availability and because of different methods of food preparation. She was familiar with *Salicornia* (probably mostly *Salicornia perennis*) as "sea asparagus" and she did not remember its Tlingit name. She knew about the use of sea asparagus as one of the boiled vegetables she ate when young and she had also "jarred it up". Emily said that jarred sea asparagus was eaten alone or in salad, mixed with herring eggs, seal oil, and sometimes celery and carrots. Emily also remembered eating young peeled stalks of Indian celery (*Heracleum lanatum* Michx.) that her grandmother also jarred.

When asked about other ways of preserving sea asparagus, Mrs. Williams said that she did not know of any, but other people may have preserved it in seal oil (commonly used for preserving berries) and some people dried part of their vegetable supply. Emily remarked that the Russians introduced salt as a way of preserving foods, and that root vegetables used to be stored in a "mud house" for winter. The root vegetables included potatoes, carrots, and turnips, the latter being eaten raw after being peeled and dipped in seal oil. The mud house was a shed where vegetables were placed on the ground and covered with mud; it was also used to store dried fish and other dried foods. Some food was preserved in seal stomachs.

Discussion

Morphology and production of *Salicornia* pollen

The steep-sided small pores and high pore rims of the chenopod pollen grains from the stomach of the Long Ago Person Found (Pl. 1, Figs. 4 and 7) clearly mark it as a *Salicornia* species. The size (1.3–1.6 µm) and pore number most closely resemble those of the *Salicornia perennis* populations sampled in this study (Table 1), although the size of the seven grains studied from the tiny (approx. 1 mm^3) sample of chyme is slightly larger than the two populations of

Fig. 2. Takhini salt flat, looking north towards the Takhini River, 3 August 2002. (A) Salt flat colonized by abundant red glasswort/samphire (*Salicornia rubra*) with *Puccinellia* grassland on the higher ground. (B) Close-up of a group (approx. 20 individuals) of annual red glasswort plants on the salt flat. The lens-cap holds drops of saline groundwater with a salt content two times greater than that of ocean water. Scale bar = 5 cm.

Salicornia perennis (Hoonah and Juneau) studied so far. Our ESEM studies (Mudie et al., in preparation) show that there is some variability in grain diameter, pore size, and ornamentation among different populations of *Salicornia perennis* and *Salicornia rubra*. In *Salicornia rubra* from the Takhini and Lake Laberge, Yukon, area, most of the variation is in the degree of folding, which may reflect either differences in grain wall thickness (see Moore et al. 1991), possibly reflecting water stress, or the possibility that many populations of *Salicornia rubra* are cleistogamous, with anthers that remain inside the protective bracts, or protrude only about 1 mm from the flowers (Fig. 2B). This feature also means that much less pollen is produced by this inland species than by the wind-pollinated coastal species. During our field work in August 2002 and 2004, we found that only the Takhini salt-flat population was producing visible anthers and pollen: the plants at alkali flats near Lake Laberge (Fig. 1) and in salt–alkali flats on the Dawson Trail road had no visible anthers ignore. Peter W. Ball (in Flora of North America Committee 2004) also reports that the anthers of *Salicornia rubra* are commonly not exerted.

All the Canadian and Alaskan coastal populations of the perennial *Salicornia perennis* produced abundant pollen in late August of 2002 and 2004 (Fig. 3B), as has been reported for *Salicornia pacifica* in tidal marshes of the Pacific coast south of Washington, USA (Mudie 1974; Mudie and Byrne 1980). We do not yet have enough samples to describe the variation among Pacific coast populations of *Salicornia europaea,* but since it is the least abundant coastal chenopod species in our study area, it is probably not very important at present. Furthermore, all populations in the region from Hoonah to Glacier Bay, except one at Young Island, Glacier Bay, appear to be cleistogamous. Vince and Snow (1984) also report that *Salicornia europaea* does not appear to reproduce at its northern limit near Anchorage. The absence of exerted stamens and the small size (<10 cm high) of this species on the northwest Pacific coast mean that it would not shed large quantities of pollen. Ongoing studies of populations of annual *Salicornia* species in salt marshes of eastern Nova Scotia show that they all produce very small amounts of pollen that is similar to that illustrated in Pl. 1, Fig. 9.

Previous records of *Salicornia* use

The earliest written record of *Salicornia* use may be that of William Turner (see Chapman et al. 1995) who in 1568 reported on an herb called Kali (also Kaly) that "hath no name in English" and is not mentioned by Dioscorides, Galen, Pliny, and other earlier authors. Turner's illustration (see Chapman et al. 1995) actually includes a specimen of the *Salicornia europaea* aggr. intertwined with *Suaeda maritima* and cf. *Salsola kali* subsp. *ruthenica*, but his description of "a stalk full of joints" can only apply to the *Salicornia*. Turner named the jointed salt marsh plant "saltwurt" because of its salty taste and because salalkali (probably potassium carbonate) was made from it. He said it could also be called either "glas wede" (because the ash was used to make glass) or "sea thrift". He reported that the seeds were eaten by larks in East Friesland, but he knew of no medicinal use. In 1636, J. Gerard also reported the use of glasse saltwort (or crab-grasse, frog-grasse) for glass making, and he noted that eating a great quantity is "mischievous and deadly", but the smell and smoke when it is burning drives away snakes (Woodward 1971). Culpeper (1653)

Fig. 3. Tidal salt marsh at the mouth of the Salmon River, Gustavus, Alaska, looking northwest towards the St. Elias Mountains. (A) Middle marsh zone covered by a sward of perennial glasswort/beach asparagus (*Salicornia perennis*), with occasional tufts of sea arrow-grass (*Triglochin maritima*) in the foreground. (B) Close-up of glasswort/beach asparagus with terminal inflorescences covered by stamens (yellow dots). Scale bar = 5 cm.

listed four kinds of jointed, leafless saltworts under the name of "salsola kali", noting that they are also called kali, glasswort, sea grass, and marsh samphire. He noted that the powder or juice of any of the four species, taken in water, is an anti-depressant and diuretic, and it "can expel the dead child" or open blockages of the liver and spleen. He also mentioned the danger of large doses but noted that when mixed with other moderate medicines, it could remove scabs and clean the skin.

In North America, the earliest written record of *Salicornia* use may be in the journals of Archibald Menzies written in 1793–1794 (Olson and Thilenius 1993). Menzies noted that samphire (usually referring to *Salicornia europaea*, but often incorrectly including young plants of *Salicornia perennis*) was endemic to the saline wetlands of southeastern Alaska and was known for its antiscorbutic properties. Between about 1867 and 1892, Edward Sturtevant noted that there was a 1789 reference to the use of tender shoots of *Salicornia herbacea* (crab grass, marsh samphire, or saltwort) as a pickle or boiled vegetable in England and gave a 1878 reference to its use for pickling in the Syracuse area of New York (Hedrick 1972). Sturtevant also mentioned a 1795 report of soldiers and a few others using *Salicornia fruticosa* L. as a salad at the Cape of Good Hope, South Africa, despite its brackish taste, and cited a 1873 reference to pickling of *Salicornia brachiata* shoots by the natives of India.

Today, the annual tidal salt marsh herb *Salicornia europaea* L. subsp. *europaea* with long succulent spikes is seasonally common in markets of East Anglia, England, where it is known as samphire, pickleweed, or glasswort (Mabey 1996). In England, the tetraploid species or varieties are preferred because of their larger size and greater ratio of succulent flesh to woody tissue (P.W. Ball, personal communication, 2003). The stalks and inflorescences are eaten raw as a salad vegetable or they are parboiled and eaten as a hot vegetable with butter. Less often, they are jarred with spiced vinegar. In Nova Scotia, Canada, the annual glasswort or saltwort (*Salicornia europaea* L., *Salicornia bigelovii* Torr.) has been used as a salad or boiled vegetable and for jarring as pickles with vinegar, sugar, onion, bayberry leaves, and mixed pickling spice (MacLeod and MacDonald 1977).

Concerning the Pacific Northwest and southeastern Alaska, Moerman (1998) comments that young plants of *Salicornia virginica* L. (probably *Salicornia perennis*) are used in salads or for pickles by Alaskan natives. He reported that the "Heiltzuk" (probably the Heiltsuk, a North Wakashan people from the central British Columbia coast) used *Salicornia virginica* as an analgesic and external antirheumatic plant and that the coastal Salish used its fleshy stems for food. The problem with Moerman's (1998) citations is the uncertainty of the *Salicornia* species to which he is referring: presumably, it includes both *Salicornia perennis* (in Alaska) and *Salicornia pacifica* Standley (south of the Queen Charlotte Islands). Norton (1981) cites the use of *Salicornia pacifica* by the Kaigani Haida as a fresh or pickled vegetable since the time of Norwegian settlement (approximately 1880–1890 in Lower Glacier Bay). Pojar and Mckinnon (1994) describe the young stalks of *Salicornia. pacifica* (sea asparagus, glasswort) as "a well known wild green vegetable, sometimes sold in chic or new-age restaurants". They also record that Aboriginal people have apparently only eaten it in recent times although some people now

harvest it as a source of income. Heller (1953) reports that around Prince of Wales Island and Ketchikan in southeastern Alaska, young plants of *Salicornia pacifica* (glasswort or beach asparagus) can be used in salads or for pickles. Streveler (1996) mentions it as beach asparagus and reports (G. Streveler, personal communication, 2002) that in the last 35 years it seems to have increased its range in Icy Strait and lower Glacier Bay, appearing in new spots and becoming more abundant in older, well-known areas. In the Gustavus region, beach asparagus is eaten either as a hot vegetable after being steamed, boiled, or lightly sauteed, or it may be pickled.

Peter Ball (personal communication, 2003) notes that fresh *Salicornia* collected at the fruiting stage remains succulent for at least 2 weeks and could last longer if collected when flowering, before the fleshy stems begin to shrivel. As first suggested by Mrs Peterson-Welsh for *Salicornia rubra*, it is clear that both coastal and inland *Salicornia* picked at the flowering time in August would be a useful food to take on a summer journey. Krause (1956; pp.135 and 278) reports that in the 1880's, trading parties of Indians from the Chilkat River traveled to Fort Selkirk (approx. 200 km north of Whitehorse) in 15–20 days, carrying dried salmon, fish oil, and flour as traveling rations. During the summer journey, only dried salmon was eaten during the day if no ripe berries were available, and the main meal was eaten in the evening. Part of the carried food was deposited in caches to be used later as needed. In contrast to these heavily laden overland trading parties, the Southern Tutchone traditionally employed young men as runners or messengers; these individuals would travel alone, with minimal supplies, to quickly spread news between settlements (D. Strand, personal communication, 2001). We do not know if the Tlingit had a similar tradition for overland communication.

Unlike the coastal species, the inland salt-flat annual *Salicornia rubra* (*Salicornia europaea* L. subsp. *rubra*) is rarely listed among the edible plant species used by Interior First Peoples (e.g., it is not listed in Turner (1997), Andre and Fehr (2001), Andre et al. (2003), or Kari (1995)). However, it is illustrated and described as red samphire (sandfire, swampfire, glasswort, corail/passe-pierre (French), or s*i*w*it*akan (Cree)) in a book on Aboriginal plant uses of Canada's Northwest Boreal forest by Marles et al. (2000). These authors refer to reports of Cree women and men from Shoal Creek, Saskatchewan, who say that the plants are washed, then "boiled and the decoction can be evaporated in a frying pan to produce salt for food use". The sparse use of *Salicornia rubra* is surprising in view of the importance of the closely related *Salicornia maritima* Wolff and Jeffries (slender glasswort) to the Gosiute people on the interior plains and plateaus of western North America (Moerman 1998). The Gosiute grind the seeds into a meal to make "sweet bread". The lesser use of *Salicornia rubra* may reflect our (P.J.M. and J.H.D.) field observations in 2002 and 2004 that Yukon populations of *Salicornia rubra* are both very small in size (approx. 1–10 cm) and they have seeds that tend to remain within the dried stems from which they subsequently germinate.

The tidal salt marsh *Salicornia* plants also have a high content of sodium and potassium carbonate salts and iodine, making them useful as a source of ash for producing glass when heated with quartz sand (Mabey 1996), in addition to their nutritional value as a source of sea salt and iodine. The related Pacific Northwest salt marsh species *Suaeda maritima* (L.) Dumortier (probably including *Suaeda calceoliformis* (Hook.) Moq. and *Suaeda depressa* (Pursh.) Wats.), commonly known as sea-blite, is also burned to ash and used as a source of carbonate of soda in glassmaking (Pojar and Mackinnon 1994). In southern California, *Suaeda californica* S.Wats. (sea-blite) was used to make a very durable, rich black dye (despite its fetid smell) by steeping it in water, and the ashed plants were used in making soap (Balls 1962).

Other North American chenopods were also used for food. According to Balls (1962), the seeds of *Suaeda californica* were harvested for pinole (flour), and the leaves were also boiled and eaten as a hot vegetable. In the Pacific Northwest, the storm tide species *Atriplex patula* L. and the related species *Atriplex gmelini* C.A.Meyer ex Bong. and *Atriplex alaskensis* S.Wats., are well-known edible herbs (spearscale, orach) that can be used in salad or as a cooked potherb (Pojar and Mackinnon 1994). *Chenopodium album* (lamb's-quarters, goosefoot) is naturalized from Europe, but many aboriginal peoples have used the young leaves as a potherb in recent times (Hultén 1968; Pojar and Mackinnon 1994). Hultén (1968) also reports that leaves of the native species *Chenopodium capitatum* (L.) Ascherson are boiled. However, Kari (1995) reports that *C. capitatum* (L.) Aschers. (strawberry blite/spinach) is avoided as a "bad luck" plant by the Dena'ina Indians of the Cook Inlet region, south central Alaska, and by some Ahtna Indians to the east. According to Moerman (1998), seeds of related native *Chenopodium* species were used as staple grains across North America in prehistoric times. Most recently (Mudie 1974; Glenn et al. 1998), farming trials were carried out in the United States and Mexico to see if *Salicornia, Suaeda* and *Atriplex* could be used for livestock feed. The results were satisfactory but cattle required more drinking water than when fed normal hay. The most promising crop was *Salicornia bigelovii* Torr., a coastal annual species similar to *Salicornia. europaea – Salicornia herbacea.* The seeds of this plant have a high polyunsaturated fat content, nutlike taste, and texture like olive oil, although the raw seeds contain saponins that make them inedible.

Comments on the possible coastal home and special *Salicornia* diet of the Kwädāy Dän Ts'ìnchi man

The high percentage (21%–43%) of *Salicornia* pollen in the stomach of the Long Ago Person Found suggests consumption of the plant when in flower, which places the time of death between late July and the end of August. Having reviewed the ethnographic data and literature on the uses of *Salicornia*, we will now consider this plant as a possible component of a specialized traveller's diet.

The Tlingit who lived at the head or north end of the Lynn Canal were widely hailed in the late 18th century travel literature for their packing and long distance overland traveling ability (Carcross–Tagish First Nation and Greer 1995). Comments referring to an individual as doing "good duty for us as packer, an art in which all T'linkit Indians are proficient" (Schwatka 1891, p. 866, as cited in de Laguna 1972, p. 187) are typical in period literature. When attempting to travel

from Klukwan to Dry Bay via the interior Tatshenshini route, Seton-Karr (1891) was advised by a group of Tlingit travellers that it was 7 days travel from their meeting point to Dry Bay. Seton-Karr (1891, p. 73), like many outsiders of that period, marveled at the ability of the travelers he met: "…these Indians…can yet carry heavier packs than a white man. They can travel farther on foot and endure greater hardships. They do not require so much in the shape of clothes and bedding".

Packing across challenging terrain such as in the Chilkat Pass, Chilkoot Pass, the interior Tatshenshini route to Dry Bay, or the Taku route to Teslin and Atlin Lakes, was not a new tradition to these people but rather part of their history (de Laguna 1972; Emmons and de Laguna 1991; McClellan 1975). The Tutchone people who lived in the middle and upper Tatshenshini basin similarly made long trips of great distance and duration, traveling down this river to visit friends and relatives on the coast and making the return journey by foot. The Tutchone also made trips overland to the Haines and Klukwan areas, and they travelled hundreds of kilometers throughout the interior (McClellan 1975). Indeed, one Dry Bay Tlingit informant interviewed in the early 20th century credited the Tutchone with teaching him how to travel (de Laguna 1972:351).

This long distance trade and travel between the coast and the interior is well documented in both archival and oral history records (Emmons and de Laguna 1991; Cruikshank et al. 1990; Legros 1984). The existence prior to the arrival of non-natives times is also verified by archaeological data (S. Greer, unpublished manuscript, 1998), although its actual antiquity is not well established in the study region. It is likely, however, that similar connections between the coast and the interior existed during the time of the Long Ago Person Found ca. 550 years ago, and that Kwädāy Dän Ts'ìnchí would have been culturally prepared for arduous long distance travel from coast to interior or vice versa.

In the late 19th century, the Tlingit reported that children were trained to pack from an early age (Emmons and de Laguna 1991, p.101). Diet may also have contributed to the packing and traveling ability although there is little information on aboriginal "trail" or travel food, and *Salicornia* has not been described as a special travel food other than its use as an antiscorbutic reported by Menzies (see Olson and Thilenius 1993). Dried salmon was the travel staple for the aboriginal people of the Tatshenshini-Alsek basin in the 19th century (CAFN oral history files), as it was for the coastal Tlingit (Seton-Karr 1891; Krause 1956, p.135). Seton-Karr (1891, p. 2) also noted the following about the aboriginal travel diet: "They are also able to supplement this [i.e., the dried salmon] with many kinds of roots, herbs and fruits which are eatable. I was endeavouring to learn from the Indians some of these useful secrets, for I have not yet met a white man who had much practical knowledge of these things". In light of Seton-Karr's observation that certain "secret" plants were also part of aboriginal travellers' diets in this area, we tentatively suggest that *Salicornia* might have been one of the special plant foods used on these long distance trips. Salt, the dominant dietary contribution of *Salicornia,* is not reported as a regular component of the aboriginal diet of either the coastal Tlingit or northern interior peoples (Emmons and deLaguna 1991; McClellan 1975). The high protein diet typically consumed by these peoples is understood to have contained sufficient salt that supplements were not necessary. Relatively small amounts (100 g) of both chum salmon and marine crabs provide 20% of the normal daily sodium requirement for Europeans (UBC Department of Food Science 1987), but these foods contain no vitamin C or other antiscorbutic-like citric acid. Given the arduous nature of travel through the high mountain passes, we suggest that *Salicornia* with its accumulated sodium chloride and antiscorbutic properties would have provided an important advantage that is analogous to the "Hi-C" energy drinks consumed today by mountaineers at high altitudes.

We must also consider, as suggested by Mrs. Schinkel in this paper, that the *Salicornia* consumed by Kwädāy Dän Ts'ìnchí might have been a "special" plant, eaten only by certain members of society or under certain conditions. If either of these is the case, we expect that knowledge of the traditional uses of this plant would not be something that is widely shared, and therefore unlikely to be revealed under the ethnographic research methods employed in this study (see Materials and methods). Cruikshank et al. (1990) further discuss the limits on oral transfer of traditionally secret information, particularly that pertaining to health matters.

Conclusions

ESEM imagery can be used to identify the main native chenopod pollen genera in the Pacific Northwest, using a combination of grain size, the number and size of the pores, and pore morphology and ornamentation. *Salicornia* pollen is distinguished primarily by the presence of steep-sided pores surrounded by prominent pore rings; the grains are also relatively small (<23 μm in diameter). Pollen of coastal and inland species of *Salicornia* from the Pacific Northwest can be distinguished using ESEM images. The inland salt-flat species *Salicornia rubra* has larger grains with relatively large pores and a thin wall that crumples easily. The thin pollen grain wall and the cleistogamous pollination of many populations may be related to the annual habit and short-growing season of this species that rarely produces exerted stamens. These characteristics also limit the amount of pollen that could be produced by the inland plants and its annual coastal counterpart, *Salicornia europaea*. The annual plants are also small (approx. 10 cm) and bear little edible fleshy tissue. In contrast, on the Pacific coast of North America, the larger (approx. 30 cm) perennial coastal species, *Salicornia perennis* and *Salicornia pacifica*, produce abundant pollen on fleshy spikes that have been harvested in southeast Alaska since at least the time of Norwegian settlement in the 1880's.

Traditional use of the small inland annual species of *Salicornia rubra* is not known to either the Champagne, Aishihik and Tagish people of the Southern Yukon region, or the Gwitch'in people, although it is sometimes used by the Cree further inland and the Gosiute to the south use a larger related species, *Salicornia maritima*. It is also not definitely known how far back in time the coastal plant has been used by the Tlingit and Haida First Nations of the southeastern Alaskan coastal region, although its use is well known to people living on the coast today.

The *Salicornia* pollen grains from the stomach of the Long Ago Person Found were most likely produced by a coastal perennial species rather than an inland or coastal annual species. When viewed by ESEM, the pore size, pore shape, and the microornamentation of grains from the perennial coastal species are most similar to the *Salicornia* grains found in a stomach sample and in one robe sample. This fact, combined with the greater pollen production capacity of these succulent perennials, make it more likely that the source of these pollen grains was food obtained in the coastal marshes, possibly around Glacier Bay, than from an inland source. Detailed ESEM study of pollen grains is thus an important tool for forensic studies of ancient people and provides clues that may be helpful in reconstructing the paths that were travelled many centuries ago. Consideration of the pollen in the digestive tract has established the movements of Kwädāy Dän Ts'ìnchí in his final days and time spent on the coast is indicated. Whether this information pertains to his last journey only, or also indicates his place of residence and cultural affiliation is at present uncertain, but clearly it is a piece of the puzzle that must be considered in establishing who the Long Ago Person Found was.

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