



DEPARTMENT OF BIOLOGY

UNIVERSITY of WASHINGTON

November 3, 2022

Attn: Michael Polenz, L.G., L.E.G.
Washington Department of Natural Resources
Washington Geological Survey
1111 Washington Street SE, MS 47007
Olympia, WA 98504-7007

Dear Michael,

Enclosed is my report on the relative frequencies of palynomorphs from the Mashel Formation, sample number **BHm016B (8-18-2022) MP+TC** and my opinion of their biostratigraphic significance. This sample contains beautifully preserved pollen, but at a very low concentration (~3600 palynomorphs/g sediment).

	Pollen type	Common name	Absolute ct.	Relative frq. (%)*
Conifers	Cupressaceae/Taxaceae	Cedar family	30	8.5
	<i>Abies</i>	Fir	3	0.9
	<i>Pinus</i> subg. <i>Pinus</i>	Yellow pine	13	3.7
	<i>Pinus</i> undiff.	Undiff. pine	10	2.8
	<i>Tsuga</i> subg. <i>Tsuga</i>	Hemlock	4	1.1
	Podocarpaceae/ <i>Cathaya</i> -type	Podocarp family	1	0.3
	Coniferae (bisaccate) undiff.	Undiff. conifers	39	11.1
Hardwoods	<i>Liquidambar</i>	Sweetgum	4	1.1
	<i>Alnus</i>	Alder	15	4.3
	Betulaceae (triporate) undiff.	Birch family	1	0.3
	<i>Quercus</i>	Oak	1	0.3
	Rosaceae	Rose family	5	1.4
	<i>Salix</i> /cf. <i>Salix</i>	Willow	187	53.3
	<i>Acer</i>	Maple	1	0.3
Herbs	Poaceae	Grass family	3	0.9
	Cyperaceae	Sedge family	9	2.6
	Apiaceae	Carrot family	1	0.3
	<i>Artemisia</i>	Sagebrush	1	0.3
	Unknown (tricolpate, psilate)		10	2.9
	Unknown undiff.		13	3.7
	Pteridophyta (monolete, psilate)	Ferns	14	3.5
	Indeterminable		37	9.2
	Pollen Σ		351	

*Expressed as a percentage of total terrestrial pollen, except Pteridophyta, Indeterminable which are expressed as a percentage of total palynomorphs

The dominance of *Salix* pollen, together with *Alnus* and Cyperaceae, points towards dense riparian vegetation surround the waterbody, but obscures the record of extralocal and regional vegetation. **The co-occurrence of Podocarpaceae/*Cathaya*-type, *Liquidambar*, and *Artemisia* pollen is consistent with a Middle to Late Miocene age.** To my knowledge, the oldest records in western North America of *Artemisia* date to about 12 Ma¹. Podocarpaceae/*Cathaya*-type (except for a persistent population in Alaska²) and *Liquidambar*³ are conversely absent in our region by the Pliocene. Compared with a somewhat similar Late Miocene flora at Vasa Park, King County⁴, "Tertiary relict taxa" such as Podocarpaceae/*Cathaya*-type and *Liquidambar* are quite rare, but I feel confident in those identifications.

Paul Kester has dropped off a collection of Mashel Fm. plant megafossils at the Burke, from which I may be able to do additional palynological work. Please let me know if that would be useful. It is also worth noting that the paleovegetation of the Late Miocene is not as well

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understood in our region as the Middle Miocene. I would be very interested to look at additional material from this time period so that we can help fill this gap in our knowledge. Thank you for including me in this process! Let me know if you have any questions or if I can be of any further assistance!

Take care and keep well,

A handwritten signature in black ink, appearing to read 'Chris Schiller', with a stylized flourish at the end.

Christopher M. Schiller

1. Davis, O.K. & Ellis, B. Early occurrence of sagebrush steppe, Miocene (12 Ma) on the Snake River Plain. *Review of Palaeobotany and Palynology* 160, 172–180 (2010).
2. Reinink-Smith, L.M., Zaborac-Reed, S. & Leopold, E.B. Clamgulchian (Miocene–Pliocene) pollen assemblages of the Kenai Lowland, Alaska, and the persistence of the family Podocarpaceae. *Palynology* 42, 66–101 (2018).
3. Leopold, E.B., Liu, G., Love, J.D. & Love, D.W. Plio-Pleistocene climatic transition and the lifting of the Teton Range, Wyoming. *Quat. res.* 67, 1–11 (2007).
4. Dillhoff, R.M., Dillhoff, T.A., Jijina, A.P. & Stromberg, C.A.E. The Vasa Park Flora, King County, Washington, U.S.A.: A Window into the Late Miocene of the Pacific Northwest. in *Paleobotany and Biogeography: A Festschrift for Alan Graham in His 80th Year* (eds. Stevens, W. D., Montiel, O. M. & Raven, P. H.) 64–97 (Missouri Botanical Garden Press, 2014).