

An IAFI Puget Lobe Chapter newsreel:

Introduction to the Milankovitch Theory (CH 1 p. 1)

This newsreel feature of the IAFI Puget Lobe chapter is designed to provide a history and glacial features of Continental Ice Sheets commonly expressed in the Puget Sound area as the Puget Lobe of the Cordilleran Ice Sheet. Evidence of Ice Sheets are found in the Pacific NW, along the northern tier of states (Laurentide), and in Europe, Asia, and Antarctica.

We know they existed by the physical evidence they left behind, such as:
Moraines, eskers, kettles, kame terraces, erratics, etc.
Whalebacks, roche moutonnée, drumlin fields, mega flutes, till, drift, erratics, marine sediment from deep sea cores, ice cores, lake varves, strand lines, etc.

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Let's look at some terminology:

Continental Ice sheets – are unconstrained by topography

Ice Sheets – greater than 50K km²

Ice Caps – Less than 50K km²

Glaciers constrained by topography

Highland Ice Field – between 10 - 50K km²

Valley Glacier – between 6 - 9K km² (most common we see in PNW)

Cirque Glacier – between .5 - 10 km²

Piedmont Glacier – valley glaciers debouch on to Lowland areas after traveling through bedrock troughs, they form piedmont glaciers or lobes. (Benn and Evans 1998, p16-21)

We will return to Piedmont Glaciers in Ch 6.

Not: see Bennett & Glasser, 1996, p.2 for expanded descriptions with area)

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We are reasonably certain of the chronology of recent ice sheets or glaciations, even though there are blank spots in the chronology here in the PNW prior to Double Bluff

What we very seldom hear about is how – how did they come about?

What mechanisms would “cause” Continental Ice Sheets to form, advance, “recede”, maybe re-advance, and subsequently disappear

As far back as 1842, French mathematician, J. Adhémar, suggested “that shorter-term quasi-periodic orbital variations might cause oscillatory changes in solar heating”.

This was elaborated upon by a Scotsman, James Croll. (Williams, p. 73)

The orbital variations of the earth cause more or less sun (insolation) to reach the earth’s surface particularly in the mid-latitudes and polar regions

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Serbian mathematician, Milutin Milankovitch (1879-1958) spent numerous years calculating the orbital parameters of the earth, moon, other planets and how the parameters changed in the Quaternary and affected the climate.

He felt his calculations (1941) accounted for “particular orbital changes and their presumed effect on key parts of the Earth as providing the key to the glacial cycle” (Williams, p. 74)

W. Köppen, a famous German Climatologist and Alfred Wegener of continental drift (shifting) used Milankovitch’s work and radiation curves in their 1924 book.

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Köppen suggested to Milankovitch that summer insolation was the determining factor

Milankovitch calculated summer radiation at 55°, 60°, and 65° N for the last 650Ka

Köppen noted the lines on the graph Milankovitch provided “could be matched reasonably well with the history of the Alpine glaciers as reconstructed ...by German geographer A. Penck and E. Brückner.” (Imbrie. p. 105)

His work was originally accepted; however, during the 1950's, because there were no methods to substantiate his work, his theory were laid aside (torpedoed by C¹⁴)

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With greater fidelity of dating methods after the 1960's his theory gained acceptance and has been refined (slide rule versus computers, ice core drilling and analysis, advanced chemical analysis – Milankovitch probably just had the slide rule and hand-pull calculator)

Subsequent work has refined and improved upon his Theory.

In Ch 2 we will look at earth's orbital parameters