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THE NEOPROTEROZOIC WINDERMERE SUPERGROUP: AN ON-LAND CONTINENTAL MARGIN TURBIDITE SYSTEM (SHEET 1 OF 2).

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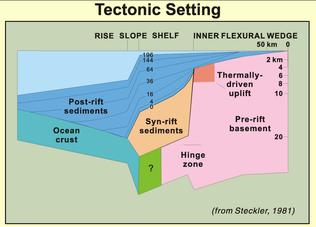
ABSTRACT

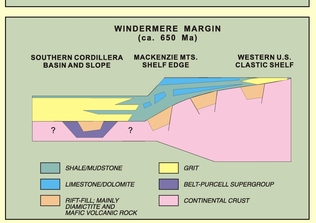
The Windermere Supergroup is a regionally widespread succession of predominantly deep marine sedimentary rocks deposited on the continental margin of western Canada following its separation from Australia ca. 700 Ma. A vertical succession from sand-rich basin plain turbidites to mud-rich slope facies occurs over a ca. 7 km thick stratigraphic interval and records the progradation of the continental margin attendant with diminished rates of thermally-driven subsidence. Although unfossiliferous and deformed in the Mesozoic, careful stratigraphic mapping, utilizing a lithologically distinct condensed interval (**SHEET 2**) and two carbonate-rich lowstand intervals have established regional continuity of this depositional system over ca. 4° of latitude. The continuity of the depositional system has also been established using geochronology of detrital zircons which reveals a uniform provenance throughout the southeastern Canadian Cordillera (**SHEET 2**). Taken in concert with facies patterns and paleocurrent data, the Windermere grits are interpreted as a longitudinal turbidite system that flowed west-northwest, subparallel to the base of the continental margin and was fed from a distinct source area in the present southeastern Cordillera.

Basin plain facies are dominated by stacked, acyclic lobate units of thick-bedded, coarse sand to pebble grade arkose and minor intervening "classic" turbidites. In contrast, the slope facies are dominated by thin-bedded "classic" turbidites that enclose channeled coarse sand units and two deep-water carbonate intervals, the latter resedimented from the adjacent shelf during falling sea level. The contrast between slope and basin plain facies is attributed to sediment bypass such that the basin plain was the repository for much of the sand-grade material. Local evidence of syndepositional structural control is found in the slope facies and is provided by thick, sand-rich stratigraphic intervals deposited in northwest-trending structural troughs adjacent to coeval mud-rich intervals deposited on structural highs.

As pointed out by numerous workers, most ancient turbidite systems are a fraction of the size of modern counterparts. Although the Windermere turbidite system has been deformed, the establishment of stratigraphic and provenance continuity, in conjunction with published estimates of palinspastic restorations, suggests that this system was deposited over an area of at least 160,000 km^2, comparable in size to modern fans such as the Amazon and making it a candidate for one of the largest intact passive margin turbidite sequences preserved in the rock record.

Tectonic Setting





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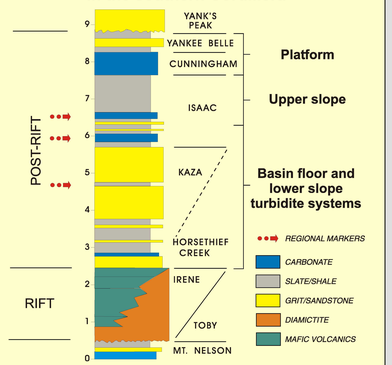
NOTE:
Although every effort has been made to ensure accuracy, this Open File Report has not been edited for conformity with Geological Survey of Canada standards.

View east from the Cariboo Mountains

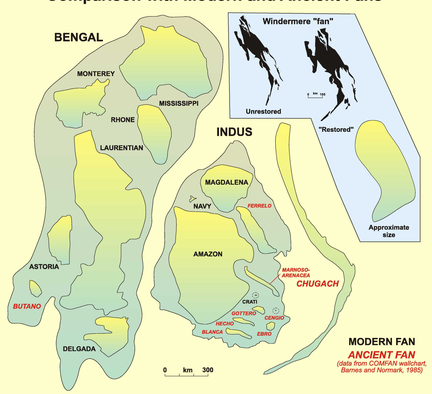
Mount Robson is visible on the skyline. Virtually all of the rocks in view are deep-water strata of the Windermere Supergroup.

Simplified Stratigraphic Column for the Windermere Supergroup in the southern Cordillera

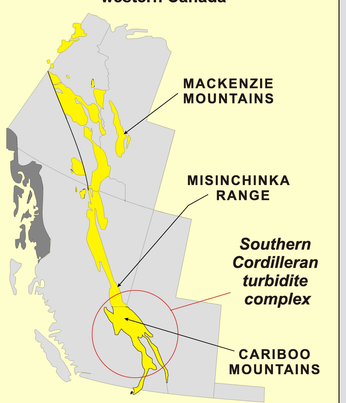


Turbidite facies predominate in the basin plain and lower slope units (Kaza Group and Isaac Formation and equivanlents).

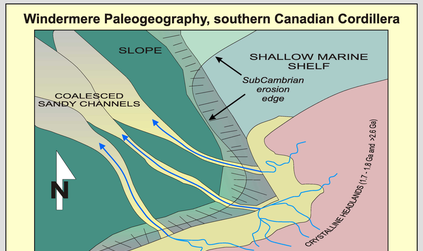
Comparison with Modern and Ancient Fans



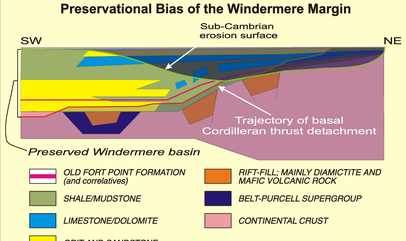
Distribution of Windermere Supergroup, western Canada



Windermere Paleogeography, southern Canadian Cordillera

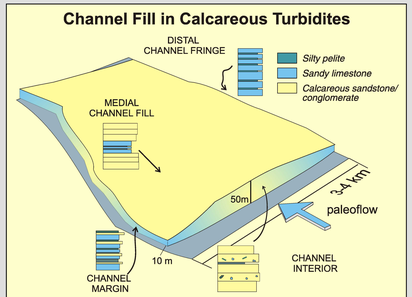


Preservational Bias of the Windermere Margin



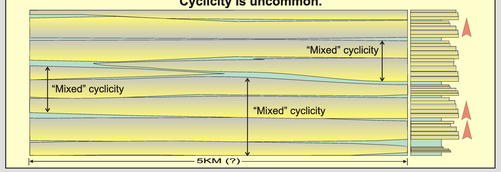
Stacked Tb(c)de turbidites composed of sandy brown limestone and green pelite from the channel margin.

Channel Fill in Calcareous Turbidites

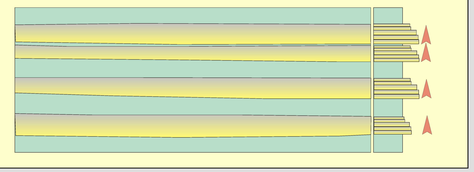


Coarse pebbly calcareous grit (Tab and graded Ta) from interior of channel fill unit.

Sand-rich Basin Floor System – "Mid-Outer Fan" (Kaza Group)
Amalgamated channel fill deposits. Individual sand sheets are not mappable.
Cyclicity is uncommon.

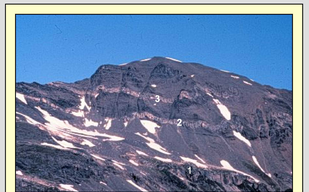


Lower Slope – "Upper Fan" setting (Miette and Horsethief Creek Groups)
Mappable sand sheets in mud-rich facies; Cyclic upward-thinning channel fill.

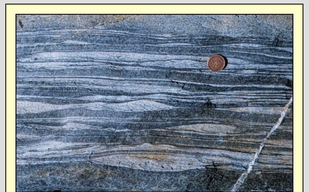


Sequence of thick Ta sandstones separated by brownish pelites. Note pinch-out of pelites and weak cyclicity in sandpackets. Tops to left.

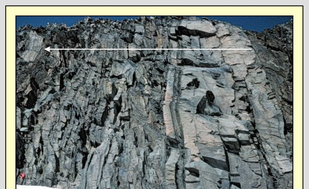
Stacked, acyclic Ta sandstones; amalgamated channel-fills



Coarse arkosic turbidite sheets (1-3) encased in silty mudrocks.

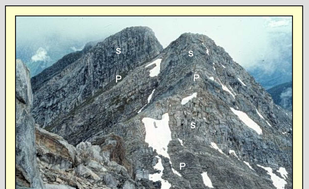


Sand-streaked and ripple-laminated mudrocks - overbank or contourite?



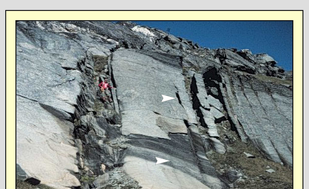
Upward-fining/thinning channel-fill cycle in calcareous grits.

Crossbed at top of graded Ta bed.

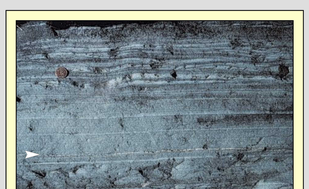


Stacked channel fill sandstones (S) separated by laminated sandy pelites (P).

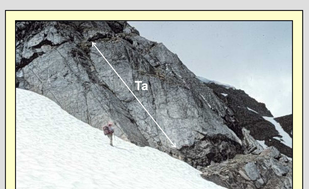
Lower part of upward thickening sequence. Note intraclasts at Ta to Tb transition.



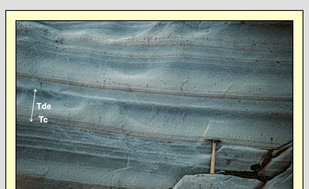
Local upward-thickening interval with pronounced amalgamation (arrows) and scour of pelite interbeds. Tops to left.



Laminated thin sands and silty pelites between thick Ta beds. Note stratiform pyrite (arrow).



Single thick turbidite (Ta) bed at base of upward-thinning /fining sequence.



Thick, fine sandy T(c)de beds in mud-rich lower slope facies.

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