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GEOLOGIC CROSS SECTION ACROSS THE CONTINENTAL MARGIN OFF CAPE FLATTERY, WASHINGTON, AND VANCOUVER ISLAND, BRITISH COLUMBIA

By

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The cross section (A-A"), of the continental margin off Cape Flattery, Wn. and Vancouver Island, B. C., extends northeastward (fig. 1) from the abyssal plain near latitude 48°00'N. and longitude 126°43'W., passes 1 km south of Shell Canada Ltd. Anglo Cygnet exploratory well (Shouldice, 1971), and terminates at a point on the coast of Vancouver Island just southeast of Nitinat Lake. A 24-channel seismic-reflection profile (fig. 2, in pocket), collected aboard the U.S. Geological Survey R/V S. P. Lee (Snavely, 1981), provided data for interpretation and construction of the offshore (A-A') part of the cross section (fig. 3, in pocket). The geology shown for the northeasternmost segment (A'-A") of the cross section (fig 3) is based upon a seaward extrapolation of onland geology and magnetic and gravity data (Tiffin and others, 1976; Snavely and others, 1976).

The seismic profile was obtained using a tuned array of five airguns totaling 1326 in^3 as a sound source. The recording system consisted of a 24-channel streamer (2400 meters long) and a GUS (Global Universal Science) model 4300 digital recording instrument. Records were sampled at a 2-millisecond rate and later processed at a 4-millisecond rate. Also collected were high-resolution seismic reflection and magnetic and gravity data. Navigational control for the survey was by satellite fixes augmented by doppler-sonar dead reckoning.

On the cross section, the Quaternary and upper Tertiary strata that underlie the broad continental slope are deformed into a series of asymmetric folds and northeastward-dipping imbricate thrusts (fig.3). These compressive structures are interpreted to result from the relative northeastward underthrusting of the Pacific (Juan de Fuca) plate beneath the North American plate. A predominantly lower and middle Miocene melange wedge is inferred to underlie the slope, and a middle to upper Eocene melange wedge is assumed to underlie the outer shelf. The complexly faulted anticlinal structure on which the Cygnet well was drilled appears to have been formed in part by diapiric uplift of the Eocene melange. The Eocene melange is inferred to be thrust beneath a wedge-shaped block of lower to middle Eocene basalt. This basalt wedge forms a regional linear magnetic anomaly which is named the Prometheus high (Shouldice, 1971; MacLeod and others, 1977); on the magnetic profile (fig. 4, in pocket), the positive (+270 gamma) magnetic anomaly south of the Calawah fault corresponds with the position of the Eocene basalts that underlie the Prometheus high. The two large positive magnetic anomalies in the southwestern part of the profile are late Miocene oceanic crust magnetic anomalies.

The left-lateral Calawah fault zone (MacLeod and others, 1977) appears to form the boundary between the Eocene basalt on the southwest

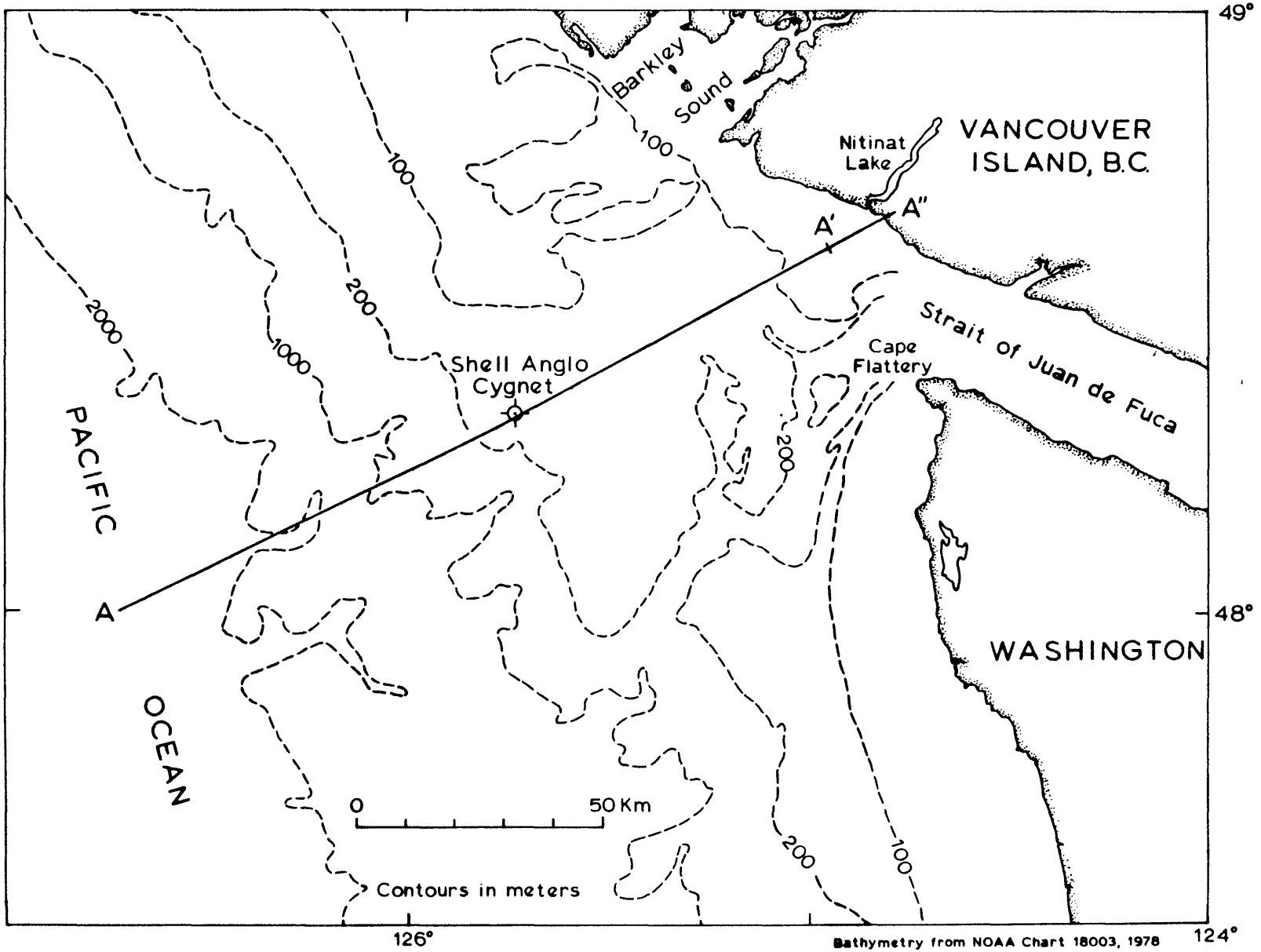

Figure 1.--Index map of continental margin off Cape Flattery, Washington and Vancouver Island, British Columbia showing location of cross section A-A".

and pre-Tertiary rocks on the northeast. On high-resolution seismic-reflection profiles, the Calawah fault and several normal faults offset the sea floor. The thick sequence of inferred Eocene and Oligocene strata that overlies the pre-Tertiary rocks northeast of the Calawah fault is cut by a low-dipping thrust fault or decollement (fig. 3). A high-angle reverse fault with large vertical separation probably lies near the coast of Vancouver Island (fig. 3) and is marked by another large linear magnetic anomaly (fig. 4). The inferred ages of the acoustical units on the cross section and their tentative correlations with formations in Washington and on Vancouver Island are shown in figure 5.

The original copy of the 24-channel seismic-reflection profile, on which the geologic cross section is based, can be examined at U.S. Geological Survey office, Room B-164, Deer Creek Facility, 3475 Deer Creek Road, Palo Alto, California and in the library of the Geological Survey of Canada, 100 West Pender, Vancouver, British Columbia. Copies of the profile on 35-mm continuous flow film are available through the National Geophysical and Solar-Terrestrial Data Center, NOAA, Boulder, Colorado 80302, telephone (303) 499-1000, extension 6542.

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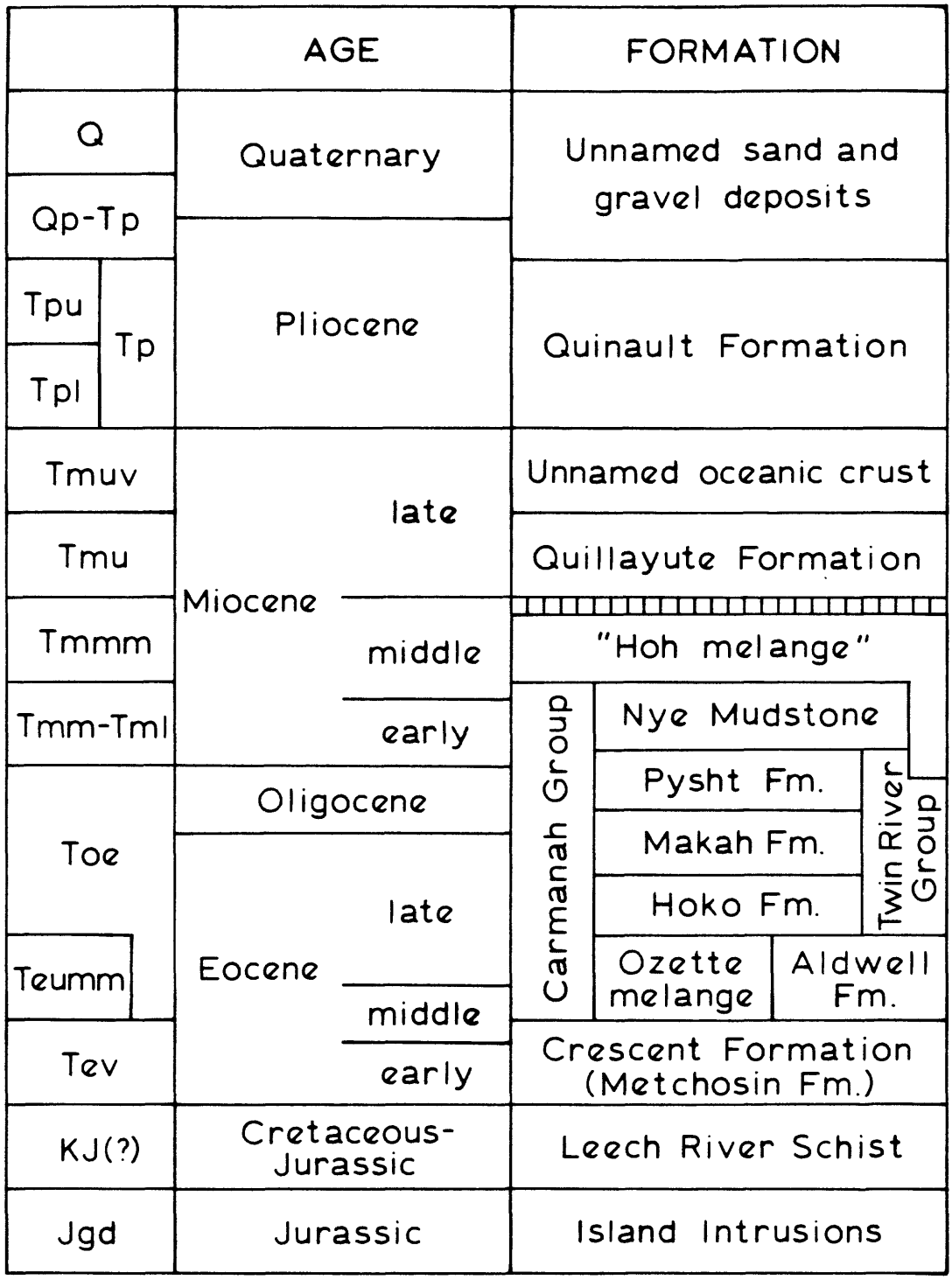

Figure 5.--Chart showing inferred ages of acoustical units on cross section and their tentative correlations with onshore formation in Washington and on Vancouver Island. For additional discussion of these formational units see Tiffin and others (1972); Muller (1977); Tabor and Cady (1978); Snavely and others (1978, 1980); Rau (1979).