APPENDIX B
GEOLOGIC HISTORY

The Coast Range is best described as a moderately deformed block of Tertiary marine sedimentary and volcanic rocks. The Tertiary beds of the southern Coast Range have been deformed (folded) along a broad north-south trending syncline (bowl shaped deposit). The southwest flank of this syncline outcrops within watershed and exposes the Lookingglass, Flournoy and Tyee Formations.

During the Middle and late Eocene period (Figure B.1-A, 43 to 38 million years ago) the submarine volcanic plate built previously during the late Mesozoic period began to subside. A long basin was created that paralleled the margin of then North America. Sediments in the form of deltas and submarine fans, were deposited Into this basin to create the early Eocene Roseburg, Lookingglass and Flournoy formations. The Tyee formation derived its sediment from a more mature drainage system that may have reached to the Idaho batholith.

In the Late Eocene to Oligocene period (Figure B.1-B, 40 to 23 million years ago), uplift along the axis of the ancestral Coast Range brought increasingly shallow water to this basin. Continued erosion of the older volcanic sediments as well as renewed eruption in the Cascades added thick layers of debris and ash to the coast plain and shelf.

From the Early to Middle Miocene period (Figure B.1-C, 23 to 15 million years ago), continued uplift produced retreating ocean waters as shorelines advanced. The continued underthrusting of the Juan de Fuca plate beneath North America produced a tilting that depressed the eastern margin of this new shoreline. The Coos Bay embayment was filled with marine deposition at this time.

The Late Miocene to Pliocene period (Figure B.1-D, 15 to 2 million years ago), saw continued uplift, faulting and deformation of the older strata as the Coast and Olympic mountains were formed. Accelerated erosion increased sedimentation on the coast where rivers transported sand to small embayments and onto the upper shelf. By late Pliocene time the shoreline was close to its present location.

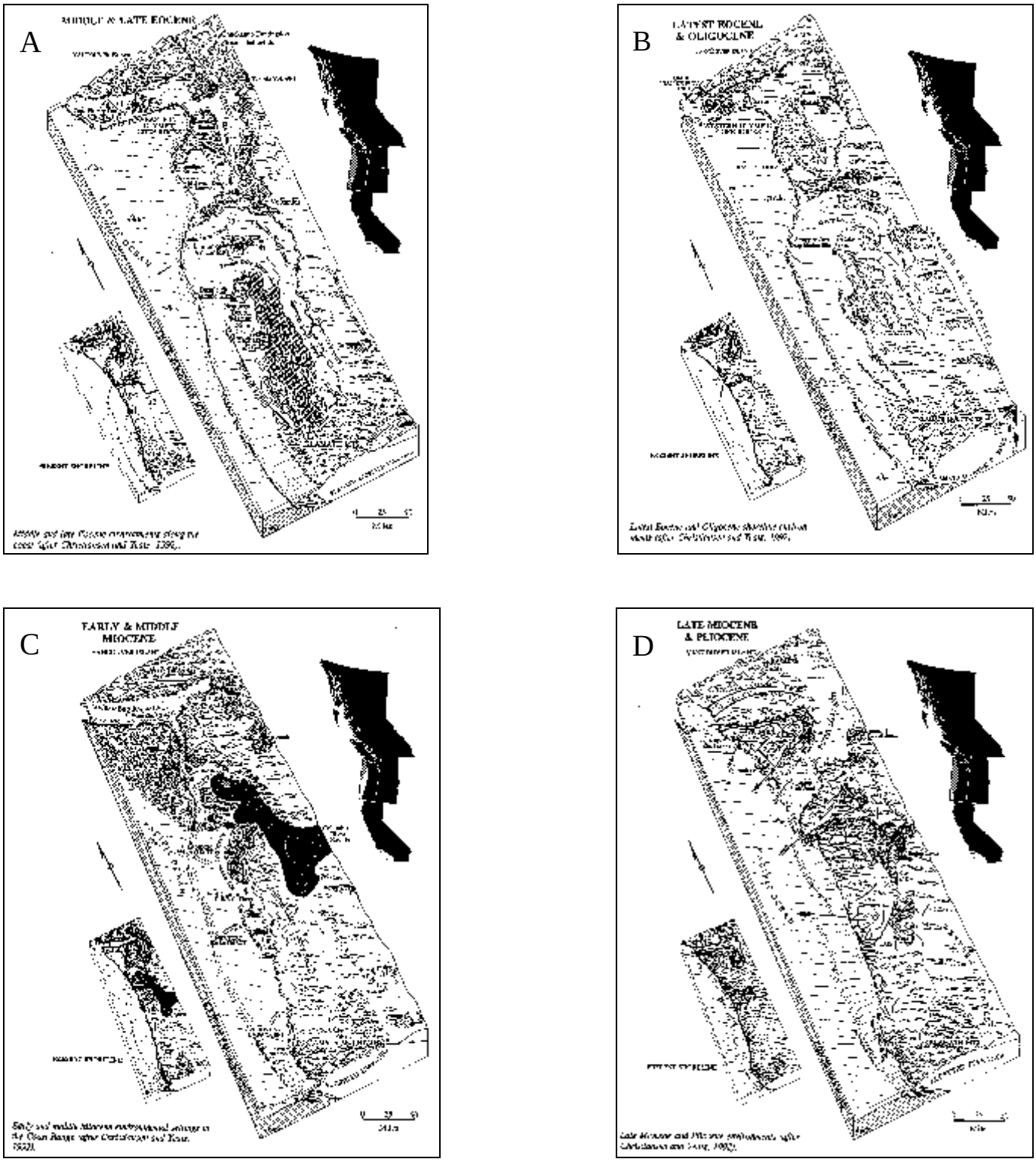

Figure B.1. Reconstruction of Middle Eocene to Pliocene environments (from Orr and Orr 1996).

Formation Origins

Otter Point

Starting at the western end of the area, the Otter Point deposits are found from the mouth of the East Fork to Weekly Creek. These deposits are thought to be displaced from a subduction trench in southern California, drifted northward and accreted to the Oregon margin that was present at the time. A complex collision of the North America plate with the oceanic plates resulted in the rotation, translation, and accretion of relatively small geologic blocks with very different histories.

Roseburg

During subduction of the ocean plates below the North American plate, the Roseburg formation ("Ter" in Figures B.2 and B.3) ceased acquiring depositional material due to uplifting. Then a deformation process began the folding and compressing of the formation and resulted in what we see today. This stage was relatively short on a geologic time scale.

Lookingglass

The Lookingglass formation ("Telg") rests on the Roseburg formation with an angular unconformity. It can be seen in Figure B.3 that the Roseburg Formation is much more deformed than the overlying Lookingglass and Flournoy ("Tef") Formations. The Lookingglass Formation represents an early Eocene marine transgression (flooding) over most of the extent of the southern Coast Range. The Flournoy formation resulted from a middle Eocene transgression and the Tyee formation ("Tet") was deposited on the Flournoy by a later middle Eocene transgression. This depositional sequence produced different dip angles in each subsequent layer. None are as great as those of the folded Roseburg formation.

The Lookingglass and Flournoy Formations consist of sediments which were transported from source areas in the Klamath highlands. The Tyee Formation has a different sediment source identified as the Idaho batholith (Lane 1987). The Tyee sediments were tectonically rotated and translated to the Coast Range from the east. The greater percentage of sandstone in the Flournoy and Tyee formations produces steeper slopes and relief than in siltstone areas underlain by the Roseburg and Lookingglass formations.

Quaternary fluvial terrace deposits ("Qft") also are shown in Figures B.2 and B.3. These are unconsolidated to semi-consolidated flat-lying and elevated deposits of river alluvium situated above present flood levels in stream valleys.

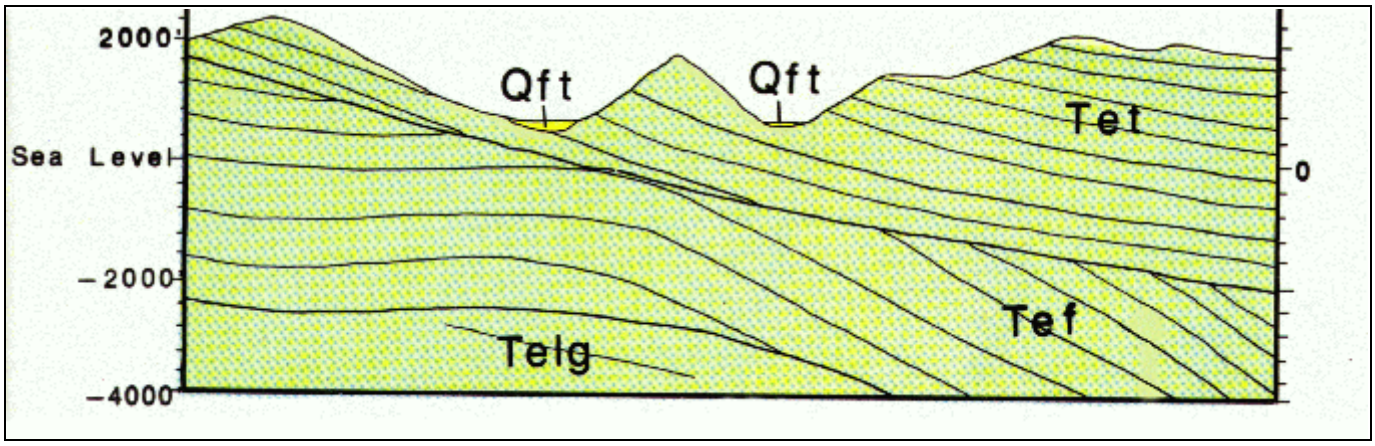

Figure B.2. Changes in bedding angle of the Lookingglass (Telg), Flournoy (Tef) and Tyee (Tet) formations (from Baldwin 1975).

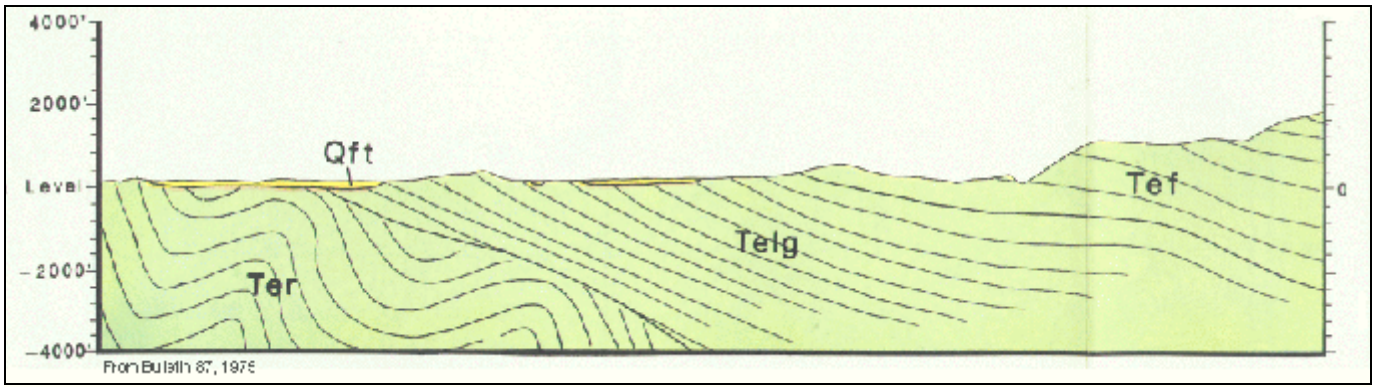

Figure B.3. Deformation of the Roseburg Formation and layering of later [Lookingglass (Telg) and Flournoy (Tef)] Formations (from Baldwin 1975).

Formation Descriptions

Otter Point

The oldest Otter Point Formation occurs in the lower portion of the East Fork Coquille. It contains low-grade metamorphic rocks of greenstone, serpentine, mica schists, and chert. Outcrops occur as large blocks surrounded by colluvium on ridges and hillsides. Otter Point sedimentary rocks are dated as late Jurassic in age (145-140 million years ago). The metamorphic rocks probably owe their origin and emplacement to Cretaceous thrust faulting and are from 65-140 million years old.

Neither the Otter Point/Roseburg Formation contact nor the thrust fault (mapped by Baldwin and Beaulieu in 1973), are exposed in the area. All other formation contacts are visible within the watershed.

Roseburg

Baldwin (1975) named and described the Roseburg Formation. This formation encompasses marine sedimentary and volcanic rocks. An outcrop occurs west of a line running from Cherry Creek Park to Frona Park and then south. The strata consists of siltstone ranging from a few inches to several feet in thickness and usually is rhythmically-bedded sand and siltstone. There is at least one occurrence of pillow basalt 2 mi. up Elk Creek, adjacent to tuffaceous siltstone. Siltstone becomes predominant within the beds in the eastern portion of the Roseburg outcrops. Roseburg sediments are intensely folded along a northeast-southwest axis. Their total thickness is unknown. Age determinations date the Roseburg Formation to the early Eocene (52-54 million years old).

Lookingglass

The Lookingglass Formation lies above the Roseburg Formation. This is classified as a lithic wacke[1] , with up to 30% rock fragments such as sandstone, schist, slate, and chert, pointing to the Klamath Mountains as a source. It is composed of thin, rhythmically-bedded, green-gray, fine-grained sandstone and slitstone, indicating marine transgression. An unconformable erosion surface separates the highly disturbed Roseburg and the gently tilted Lookingglass Formations. The Lookingglass Formation is exposed as a 2 to 2.5 mile-wide band running north-south through the west-central portion of the watershed. Approximately 2,500 ft. of this formation are exposed in the watershed. It also dates to the early Eocene (53-51 million years ago).

Flournoy

This formation is composed of a basal sandstone and conglomerate layer with a fine-grained, rhythmically-bedded, sandstone and siltstone above. Steep (cliff-face) exposures are seen in the lower, western beds. These range up to 30 ft. high and as much as 2,000 ft. long. The sandstone is gray, medium-grained, and (like the Tyee beds), highly micaceous. The Flournoy Formation lies unconformably upon the Lookingglass beds, but also dips gently eastward (at an average of 8E). Approximately 2,300 ft. of exposure (and possibly as much as 3,000 ft.), are found in the watershed between Dora and Sitkum. The lower Flournoy beds are much more resistant than the siltstones of the underlying Lookingglass Formation. Therefore the contact between steep, cliffy Flournoy slopes and the gentler, more subdued Lookingglass slopes is observable in the field, and on aerial photos and topographic maps. The same is true for the Tyee and Flournoy contact. The Flournoy Formation is early to middle Eocene (51.5 to 47 million years old).

Tyee

This formation was named by Diller in 1898 for a sequence of rhythically-bedded sandstone and sandy siltstone beds which underlie much of the southern and central Coast Range. Tyee sandstone beds are described as bluish gray to gray micaceous arkosic and lithic wackes, with a good deal of lithologic variability throughout the depositional basin. The formation is approximately 5,000 ft. thick and is exposed on the edges and core of a broad north-south trending syncline. The Klamath mountains were considered to be the likely source of the sediments but further studies point to the Idaho batholith (see Lane 1987). The displacement of the Coast Range block has

[1] Lithic wacke is a medium grained sandstone containing abundant fragments of previously formed rocks poured into a basin such that no reworking or selection occurred.

occurred since deposition of these sediments. The local Tyee beds dip gently east to northeastward an average of 7E. This formation covers the bulk (70%) of the East Fork Coquille drainage area.

Basal Tyee sandstone is exposed at Brewster Rock and on the high ridge south of Sitkum. Sandstone bedding units generally are greater than 20 ft. thick and characterized by cross-bedding having amplitudes of 8 in. or greater. The formation has medium-grained, micaceous, arkosic wacke with about 10% well-rounded pebbles (quartz and volcanic rock) and occasionally carbonaceous woody debris. The thick, cliff-forming sandstone units, characteristic of the formation, are evident on harvest cut hillslopes. The Tyee has been aged to the Early to Middle Eocene (51.5 to 47 million years ago).

Quaternary Deposits and Landslides

The analysis area has seen large scale geologic landslides and alluvial deposits. These events occurred during Pleistocene and Holocene times (about 1.2 million to 10,000 years ago), and overlie all watershed area bedrock. They form significant elements of the geomorphology and geography. Quaternary deposits include alluvium, mass movement debris, lacustrine sediment and soils.

The lower reaches of the East Fork (up to Dora), the Sitkum valley and a small portion of the mouth of Elk Creek are comprised of alluvial materials. Quaternary landslides have been found throughout the watershed. The most prominent landslide is the one that closed the main river and created Sitkum valley. This landslide covers nearly two sections of land. It blocked the mainstem river and created two distinct bowls (in T28S, R10W, Section 16) that no longer have surface water connection to the river. Mapped Quaternary landslide areas also occurred in Hantz, Steel, Elk, China, lower West Fork Brummit, upper East Fork Brummit, and middle Dead Horse Creeks.

Quaternary Terraces

A series of terraces developed in response to the alternately flooding and elevating coastal margin during changes in sea levels. The East Fork has responded to these base sea level changes by alternately eroding and filling its valley. A remnant series of fluvial terraces can be identified downstream from Dora. These terraces range from 120 to 180 ft. above the current sea level.