Notes on the regional geology for incorporation into Exploration write-up on the Debbie by Tom Schroeder et al.

Regional Setting

The Debbie property straddles the northwestern termination of the Cowichan uplift, one of a series of northwest plunging geanticlinal culminations that make up the tectonic fabric of Vancouver Island. The Cowichan uplift is cored by volcanics and sediments of the Sicker Group and rimmed by Karmutsen Formation basalts. Granodiorites of the middle Jurassic Island Intrusions intrude earlier suites. Clastic sediments of the late Cretaceous Nanaimo Group unconformably overlie all older rocks and have been intruded in turn by Tertiary porphyries.

The uplift has been cut and disrupted by a system of regional west-northwest trending contractional faults such as the Cameron River - Fulford fault and the Cowichan Lake fault. Where exposed at the surface, these are high angle reverse faults but they become listric at depth (Sutherland Brown and Yorath, 1985). They generally place older rocks over younger. Displacements along the faults are as yet unknown but are probably small, of the order of 1 to 10 kilometres, so as to maintain the essential integrity of the Cowichan uplift. Movements were probably directed to the west-southwest, though slickensides on fault planes indicate latest movement was horizontal and westerly directed. Several vertical north to north-northeast trending crossfaults, e.g. Yellows Creek - Mineral Creek fault, offset the contractional faults. These are probably west-down normal faults though some strike slip motion may also have occurred. The age of faulting is somewhat uncertain, though is post-Nanaimo Group and probably pre-Tertiary intrusions.

Regional Stratigraphy

The Sicker Group was first defined as the Mount Sicker Series by Clapp (Clapp, 1912; Clapp and Cooke, 1917) within the Duncan area. Correlative rocks elsewhere in Vancouver Island were mapped by later workers (Gunning, 1931; Stevenson, 1945; Fyles, 1955; Muller and Carson 1969) and identified as the oldest exposed rocks. Stratigraphic studies of the Sicker Group were conducted by Yole (1964, 1965, 1969) and Muller (1980). Based on regional studies throughout Vancouver Island, Muller proposed four subdivisions, in ascending order: Nitinat Formation, Myra Formation, the informal sediment-sill unit and the Buttle Lake Formation.

A major revision of this stratigraphy has been suggested by Sutherland Brown following mapping in the Alberni area of the Cowichan uplift (Sutherland Brown and Yorath, in preparation; Sutherland Brown *et. al.*, 1986) and, independently, Juras (1987) proposed a revised stratigraphy for the Buttle Lake uplift. In Sutherland Brown's revised terminology the name "Sicker Group" is restricted to the lower volcanic section and

subdivided into lower Nitinat Formation and upper McLaughlin Ridge Formation. Overlying sediments are redefined as being in the Buttle Lake Group, comprising Cameron River, Mount Mark and St Mary's Lake Formations. These new formational subdivisions have been traced successfully into the Cowichan and Duncan areas (Massey and Friday, 1987, 1988), though for convenience the older usage of "Sicker Group" was retained. The terminology of Muller is still employed by Westmin and several other companies working in the Cowichan uplift.

## Property Geology

### Mineral Creek and 900 zones

Much of the Debbie property was shown by Muller (1980) and Sutherland Brown *et. al.* to be underlain by pyroxene porphyritic volcanics of the Nitinat Formation and assorted lithologies of the McLaughlin Ridge or lower Myra Formation. Detailed mapping by Westmin has recognized an important, somewhat discontinuous package of felsic volcanics and cherts that overlies pillowed basalts. Pyroxene-plagioclase phyric flows and volcaniclastics to the north and west of this horizon have been ascribed previously to the Nitinat Formation by both Muller and Sutherland Brown, but are believed by Westmin geologists to be stratigraphically younger than the cherts and rhyolites and hence part of the Myra or McLaughlin Ridge Formation. This stratigraphic dilemma has still to be resolved.

### Rogers Creek Zone

A major schist zone has been tracked by Westmin from Yellows Creek to Rogers Creek. The chloritic schists, apparently derived from a tuffaceous protolith, show a pervasive carbonate-sericite-quartz alteration with a core zone of gypsum and minor sulphides. This zone is interpreted by Westmin as being a massive sulphide alteration zone and thin beds and lenses of sphalerite-rich massive sulphides are seen in places. However, Sutherland Brown *et. al.* (1986) ascribe the schistosity of this zone to deformation along one of the strands of the Beaufort Range fault, though this may be imposed upon earlier alteration.

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