PERGAMON

Journal of Structural Geology 21 (1999) 229–243

JOURNAL OF
STRUCTURAL
GEOLOGY

Kinematics and tectonic significance of transpressive structures within the Coast Plutonic Complex, British Columbia

Christopher L. Andronicos[a,*], Lincoln S. Hollister[a], Cameron Davidson[b], Dominique Chardon[a]

[a]*Department of Geosciences, Princeton University, Princeton, NJ 08544, USA*
[b]*Department of Geology, Beloit College, Beloit, WI 53511, USA*

Received 25 July 1997; accepted 3 September 1998

Abstract

Structural data from the Coast Plutonic Complex, near Prince Rupert, British Columbia, are consistent with a deformational history dominated by dextral transpression from Campanian to Paleocene time. Penetrative east-side-up, southwest-directed, ductile shearing produced moderately northeast-plunging overturned kilometer-scale isoclinal folds. These folds are dextrally sheared and refolded into kilometer-scale upright northwest-plunging folds and steeply dipping transposed foliations with moderate to shallow northwest-plunging lineations along their western side. An east-side-up component to the transcurrent shearing is kinematically compatible with east-side-up shearing found within the Great Tonalite Sill. Kinematic and geometric gradients and the spatial distribution of the finite stretching direction are interpreted to result from partitioning of transpression. The location of these structures and overprinting relationships suggest the Great Tonalite Sill intruded late-kinematically into a crustal-scale dextral transpressive shear zone. These results indicate this shear zone could form part of the Baja-B.C. fault system that would have accommodated large northward displacements of the terranes making up western British Columbia and southeast Alaska. This conclusion is based on: (1) It is favorably located to accommodate the proposed displacements; (2) Deformation occurred during the time period of proposed large displacement (83–59 Ma); (3) The 15-km thickness of the shear zone indicates it records large displacements. © 1999 Published by Elsevier Science Ltd. All rights reserved.

1. Introduction

Partitioning of deformation at obliquely convergent plate margins has been the subject of considerable research since Harland (1971) first applied the term transpression to such regions. Many studies of transpression emphasize the spatial partitioning of strain where horizontal shortening and transcurrent displacements are localized on steep fault zones, while contemporaneous movements on thrusts accommodate orogen-normal shortening and thickening (e.g. Fitch, 1972; Oldow et al., 1989; Holdsworth and Strachan, 1991). However, several studies show that transpressive strain can also be accommodated by extrusion of material towards the surface in steep shear zones (Robin and Cruden, 1994; Tikoff and Greene, 1997) or by vertical partitioning of displacement direction on shallow fabrics (Northrop and Burchfiel, 1996).

We present the kinematic and finite strain pattern resulting from the partitioning of transpressive strain in the middle crust during high-grade metamorphism and plutonism within the Coast Plutonic Complex, the largest magmatic arc of the North American Cordillera. Overprinting relationships and existing geochronology are used to constrain the relative and absolute timing of the structures. This study also addresses the relative displacement histories of the Intermontane and Insular Superterranes that now make up western British Columbia and southeast Alaska that are separated by the Coast Plutonic Complex (Fig. 1).

A major question in the tectonic evolution of the North American Cordillera is what are the relative orogen parallel displacements of allochthonous terranes that now make up the western Cordillera

---

* Corresponding author. E-mail: cla@princeton.edu.

0191-8141/99/$ - see front matter © 1999 Published by Elsevier Science Ltd. All rights reserved.
PII: S0191-8141(98)00117-5

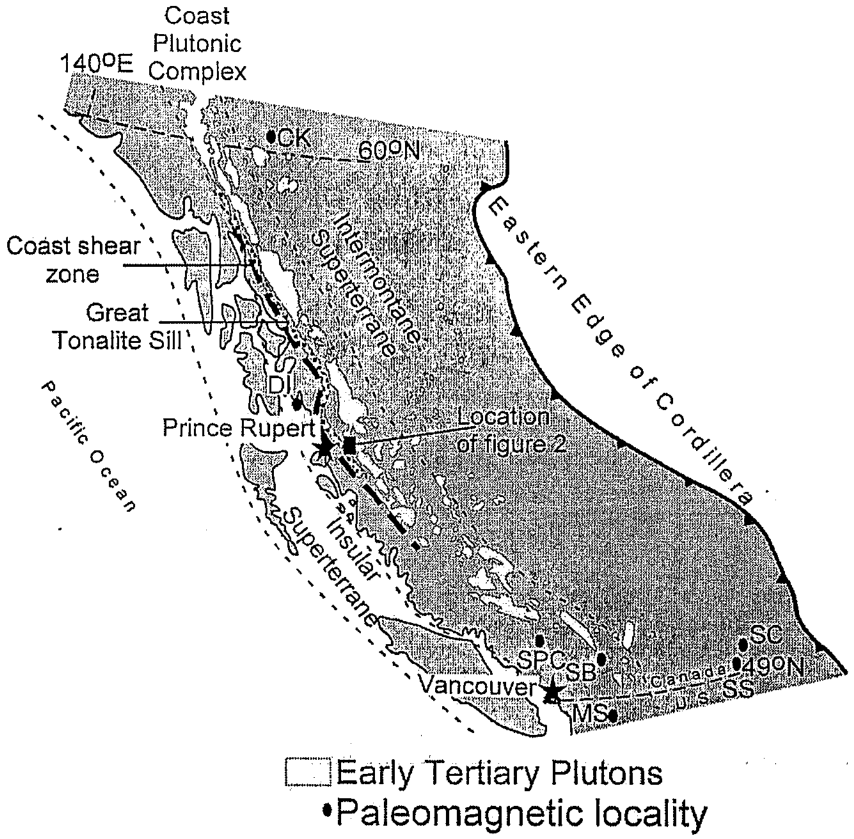

Fig. 1. Schematic geologic map of the Canadian Cordillera showing distribution of major tectonic elements and structures. Paleomagnetic locations are after Irving et al. (1996) and distribution of Early Tertiary plutons is after van der Heyden (1992). Shown paleomagnetic locations are only for localities where tilts have been estimated. The locations and approximate northward displacements are: MS—Mount Sewart Batholith 3100 km, SPC—Silverquick and Powell Creek Strata 3000 km, DI—Duke Island Complex 3500 km, CK—Carmaks Group 1500 km, SB—Spences Bridge Group 1100 km, SC—Skelly's Creek Batholith ~undisplaced, and SS—Summit Stock ~undisplaced. Note that displacements increase from east to west in adjoining tectonic domains and also from north to south in individual tectonic domains.

(Oldow et al., 1989; Cowan et al., 1997; Hollister and Andronicos, 1997). Viewpoints are divided into mobilist and stationary models with the latter emphasizing orogen-normal motions and the former advocating large northward orogen-parallel displacements (> 1000 km) (Cowan et al., 1997; Hollister and Andronicos, 1997). Mobilist models are based principally on paleomagnetic and paleontologic data sets that suggest thousands of kilometers of northward displacement for these terranes relative to cratonic North America between 83 and 45 Ma (Fig. 1) (Champion et al., 1984; Taylor et al., 1984; Umhoefer, 1987; AvéLallemant and Oldow, 1988; Oldow et al., 1989; Irving and Wynne, 1990; Bogue, 1995; Ague and Brandon, 1992, 1996; Irving et al., 1995, 1996; Wynne et al., 1995; Ward et al., 1997). However, in southeast Alaska and British Columbia, geologic structures record predominately orogen-normal shortening deformation (Crawford et al., 1987; Rubin et al., 1990; Stowell and Hopper, 1990; Cook and Crawford, 1994; Ingram and Hutton, 1994; Klepeis et al., 1998), and dextral offsets on known faults are insufficient to account for the proposed large displacements (Price and Carmichael, 1986). Symons (1977) and Butler et al. (1989) point out that paleomagnetic data used to infer translation can be explained by tilting of the plutons instead of a large northward offset combined with clockwise rotation. However, other studies have made corrections for tilting and conclude that large northward displacements have occurred within the Cordillera based on the paleomagnetic data (Irving et al., 1996 and references therein).

The kinematics and chronology inferred for the structures described here are consistent with dextral, orogen-parallel displacements within the Coast Plutonic Complex, implying relative dextral displacements between the Insular and Intermontane Superterranes having occurred between 83 and 59 Ma.

2. Geologic setting

The study area is located within the high-grade core of the Coast Plutonic Complex (Fig. 1) that records voluminous plutonism from the Jurassic to the Tertiary (Armstrong, 1988; van der Heyden, 1992). The western part of the study area is defined by the Coast shear zone, a crustal-scale structure, separating high pressure (0.8–0.9 GPa) amphibolite facies metamorphic rocks and associated Mid-Cretaceous plutons to the west, from lower pressure, higher temperature metamorphic rocks to the east (Fig. 1) (Crawford et al., 1987). The Coast shear zone is an 800 km long (minimum length) near vertical shear zone with a polyphase deformation history and is intruded by large volumes of synkinematic tonalite plutons defining the Great Tonalite Sill (Fig. 1) (Stowell and Hopper, 1990; McClelland et al., 1992; Ingram and Hutton, 1994; Klepeis et al., 1998).

Stowell and Hopper (1990) reported east-side-up displacement followed by dextral strike slip shearing during cooling for a portion of the Coast shear zone in southeast Alaska. McClelland et al. (1992) describe a complex history for the Coast shear zone involving both east-side-up and west-side-up down-dip displacements and suggested west-side-up motions were responsible for exhumation of the batholith complex. According to Ingram and Hutton (1994) this shear zone records predominately northeast over southwest reverse shear and intense flattening synchronous with the emplacement of the Great Tonalite Sill in southeast Alaska and British Columbia. Klepeis et al. (1998) inferred a polyphase deformation history for the Coast shear zone in southeast Alaska. Between 65 and 57 Ma, the Coast shear zone was affected by northeast-over-southwest reverse shearing; then, after 57 Ma, it was affected by penetrative west-side-up shearing parallel to a down-dip mineral (sillimanite) lineation on the western margin of the shear zone.

Intruded into the Coast shear zone is the Great Tonalite Sill, which comprises a string of elongate plutons (Fig. 1) intruded during the Late Cretaceous and Early Tertiary (Brew and Ford, 1978; Ingram and Hutton, 1994). The plutons are generally less than 20 km in thickness with steep to subvertical contacts and can be traced along strike for at least 800 km (Ingram and Hutton, 1994). The individual plutons that make up the batholith range in age from 83 to 57 Ma (Gehrels et al., 1991). The Quottoon pluton is the southernmost pluton in the Great Tonalite Sill and intrudes the Coast shear zone and stretches over 200 km from southeast Alaska to the southeast of Prince Rupert, British Columbia and has an average thickness of 10 km (Fig. 2). Within the area of Fig. 2 the Quottoon pluton is a weakly to strongly foliated medium grained hornblende–biotite tonalite. A U/Pb zircon date of 58.6 ± 0.8 Ma has been determined for the Quottoon pluton from its eastern side along the Skeena River (Gehrels et al., 1991).

Previous workers in the region have emphasized the Coast shear zone as being located along the western side of the Great Tonalite Sill (Stowell and Hopper, 1990; McClelland et al., 1992; Ingram and Hutton, 1994; Klepeis et al., 1998). However, we use a broader definition of the Coast shear zone, which includes the Great Tonalite Sill, steeply dipping structures along the eastern sides of the sills, as well as the steeply dipping high strain zone on the western side of the Great Tonalite Sill.

Paragneiss, orthogneiss, migmatite, leucogneiss and amphibolite are the predominate country rocks in the Coast Plutonic Complex (Fig. 2) and define the Central Gneiss Complex (Hutchison, 1982). The paragneiss consists of aggregates of plagioclase + quartz + biotite with variable amounts of sillimanite, garnet, cordierite, and spinel. Orthogneiss and migmatite consist of strongly foliated aggregates of plagioclase + - quartz + biotite + hornblende. Amphibolite units are finer grained and are composed of aggregates of hornblende and biotite with lesser amounts of plagioclase, pyroxene and quartz. Small mafic to ultramafic intrusions occur throughout the mapped area and range in composition form hornblendite to pyroxenite.

Intruding the northeast portion of the mapped area is the Kasiks sill complex (Fig. 2). It is diorite to tonalite in composition and dips moderately north. Andronicos et al. (1997) reported U/Pb zircon ages from the sill complex that suggest it intruded and crystallized between 54 and 52 Ma. Intrusion of the sill complex was synchronous with north-directed extensional shearing, vertical shortening, and exhumation which ended by ~48 Ma (Andronicos et al., 1997; Chardon and Andronicos, 1997). Superposition relationships and existing geochronology indicate that the intrusion of this sill complex post-dates the structures that are the focus of this paper.

Metamorphic grade in the study area varies from amphibolite to granulite facies (Hollister, 1975, 1982). Lappin and Hollister (1980) determined metamorphic grade within gneiss on the west side of the Quottoon Pluton where they reported conditions of 675–750°C at a pressure of 0.6–0.8 GPa during anatexis. On the eastern side of the Quottoon pluton, and south of the Skeena River, peak metamorphic conditions were determined by Kenah and Hollister (1983) to be 0.45 GPa at temperatures > 825°C during intrusion of the Quottoon pluton. Selverstone and Hollister (1980), in a study of granulites just to the east of the map area of Fig. 2 and south of the Skeena River, reported conditions of metamorphism of 725–775°C and 0.42–0.55 GPa. Hollister (1982) integrated these *P*–*T* determinations with mineral textures and fluid inclusion

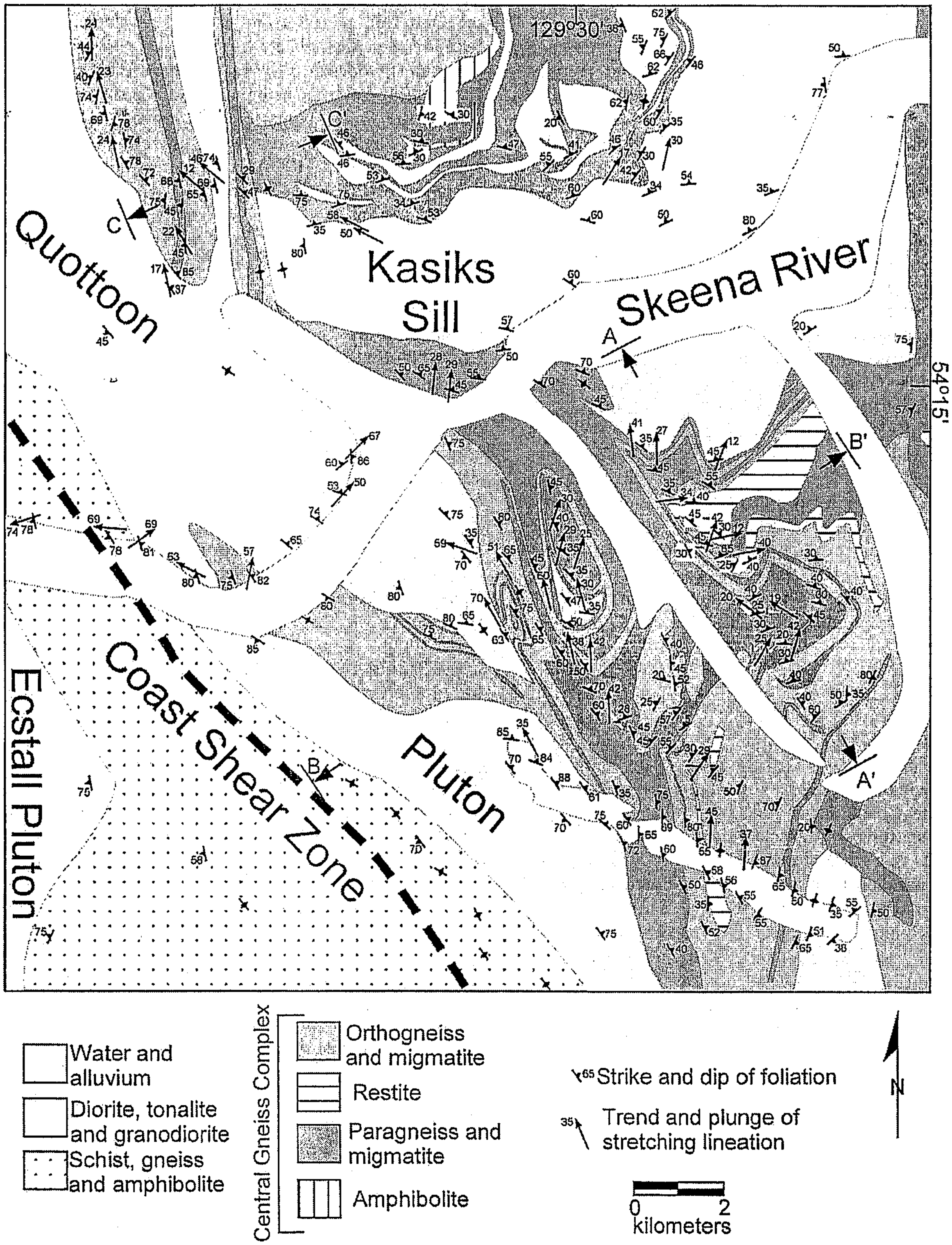

Fig. 2. Geologic map showing the region of this study within the Coast Plutonic Complex. Lines of cross-sections of Fig. 4 are shown. Dashed line marked Coast shear zone shows the topographic lineament associated with the mylonites of the Coast shear zone west of the Quottoon pluton.

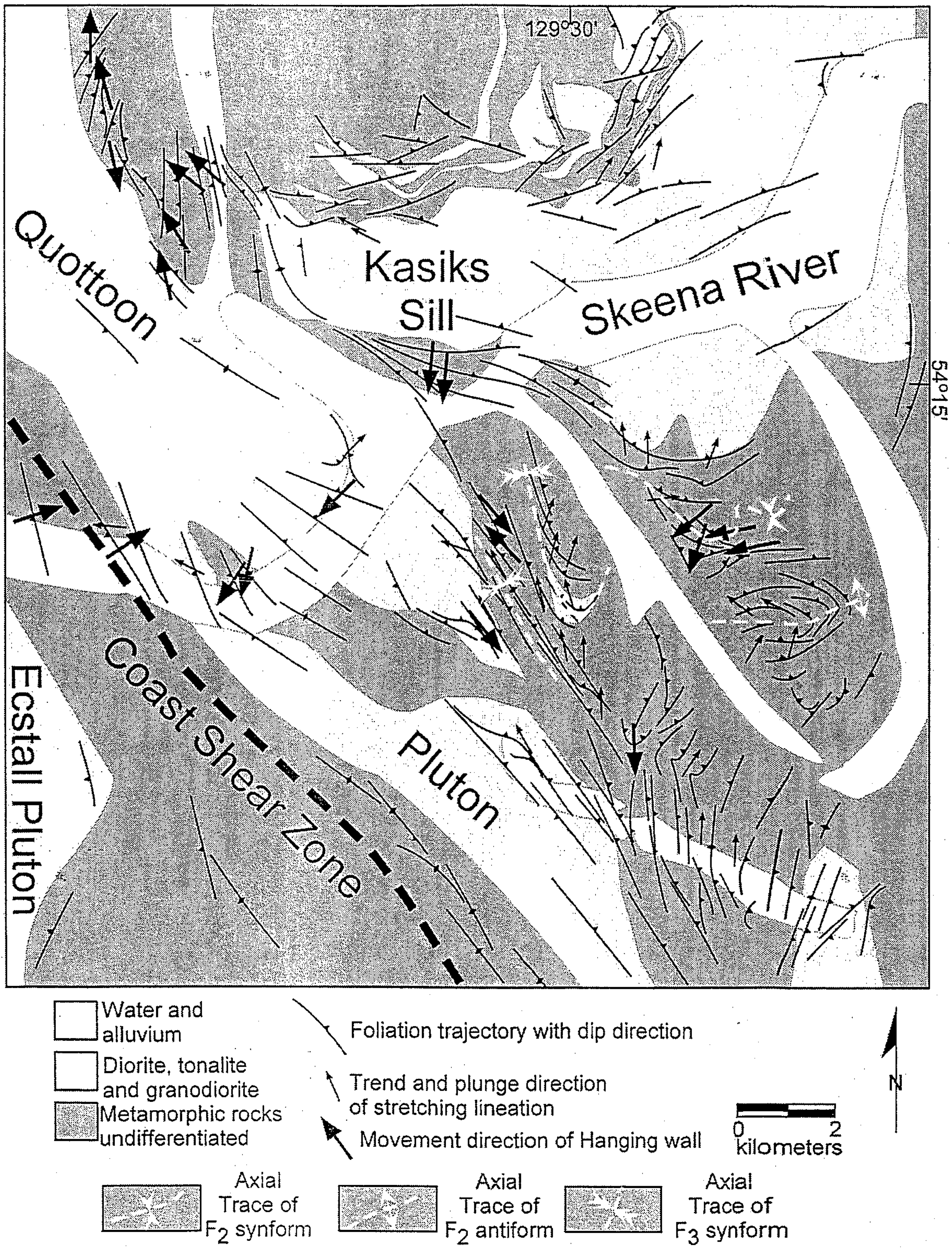

Fig. 3. Foliation trajectory map based on the data in Fig. 2. Dashed line marked Coast shear zone shows the topographic lineament associated with the mylonites of the Coast shear zone west of the Quottoon pluton.

data into a model for a clockwise P–T path for the area east of the Quottoon pluton from the kyanite stability field to conditions of ~750°C and ~0.5 GPa and ending at ~0.25 GPa and ~550°C.

3. Structure and kinematics

The structures seen in the study area are discussed from the southeast to northwest. Because the study area records a polyphase deformation history, the earliest fabric elements are described first; this is followed by a description of the overprinting relationships and the geometric gradients between areas. Following this section, we outline the kinematics for the region. The structural and geologic data for the structural analysis are summarized in Fig. 2. Local foliation measurements presented in Fig. 2 were interpolated to produce the foliation trajectory map shown in Fig. 3 (e.g. Brun and Pons, 1981) which summarizes the structure and kinematics of the study area.

First order generalizations can be made about the study area based on these maps. As can be seen from Figs. 2 and 3, the southwestern side of the study area is dominated by northwest-striking, steeply dipping foliations with nearly down-dip lineations. In contrast, the northeastern side is dominated by roughly east–west striking, shallowly dipping foliations. There is a deflection and general convergence of these foliations going towards the west into the northwest-striking foliations surrounding the Quottoon pluton.

3.1. Geometry, orientation and distribution of fabrics

The oldest generation of fabrics in the study area is located south of the Kasiks Pluton and east of the Quottoon pluton (Figs. 2–4a). A gneissic banding (S_1) in paragneisses is defined by the alternation of mica/sillimanite rich layers with leucocratic layers composed

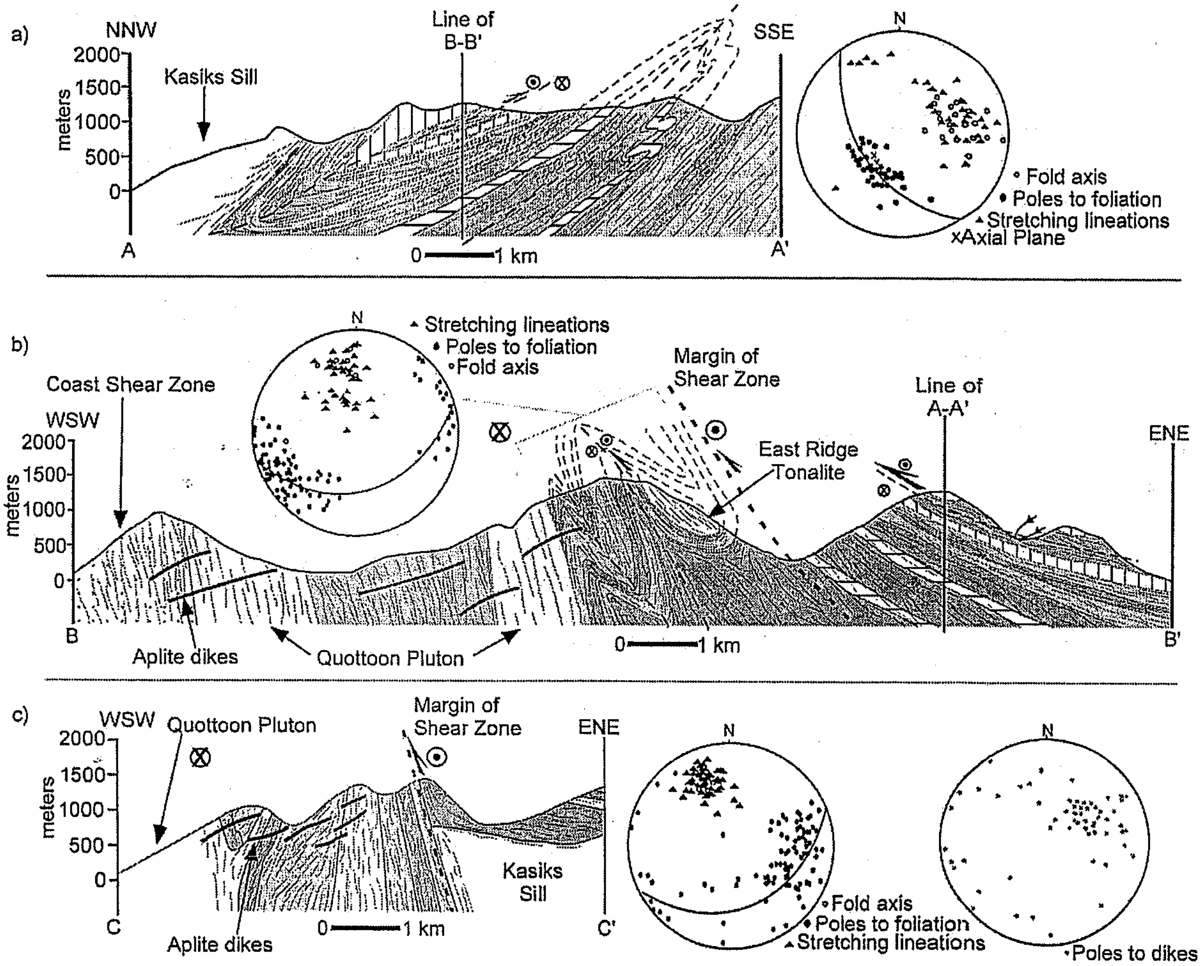

Fig. 4. Interpretive cross-sections and stereonets summarizing the structures shown in Figs. 2 and 3.

predominately of plagioclase + quartz (Fig. 5). In orthogneiss, the gneissic banding is not as strongly differentiated as in the paragneiss and is defined principally by aligned amphibole and biotite grains, whereas plagioclase and quartz grains have a polygonal equigranular texture.

The gneissic banding (S_1) is folded into east-northeast plunging, northeast-dipping isoclinal folds (F_2). The folds have amplitude of ~7 km and a wavelength of 1.5 km. Axial planar cleavage is absent from F_2 folds, although the gneissic layering in the limbs of the folds is roughly parallel to the axial surface of the folds. A prominent lineation (L_2) defined by sillimanite is developed parallel to the fold hinges in the paragneiss. L_2 mineral lineations in other rock types also parallel the fold hinges (Fig. 4a). The fold hinges are locally boudinaged parallel to the mineral lineations. At the map scale, lineations plunge northwest on the northern limb of the F_2 antiform to northeast on the southern limb (Figs. 2 and 3). This suggests that earlier lineations (L_1) are refolded.

Across the strike of these structures, and towards the base of the Kasiks sill, lineations and fold axes are reoriented to north plunges (Figs. 2 and 3). Hollister and Crawford (1990) suggested that this reorientation occurred during intrusion of the Kasiks sill. This interpretation is supported by our observations along the north side of the Skeena River between the Kasiks and Quottoon plutons, where gneiss has shallow north dips which we interpret to be on the northern limb of

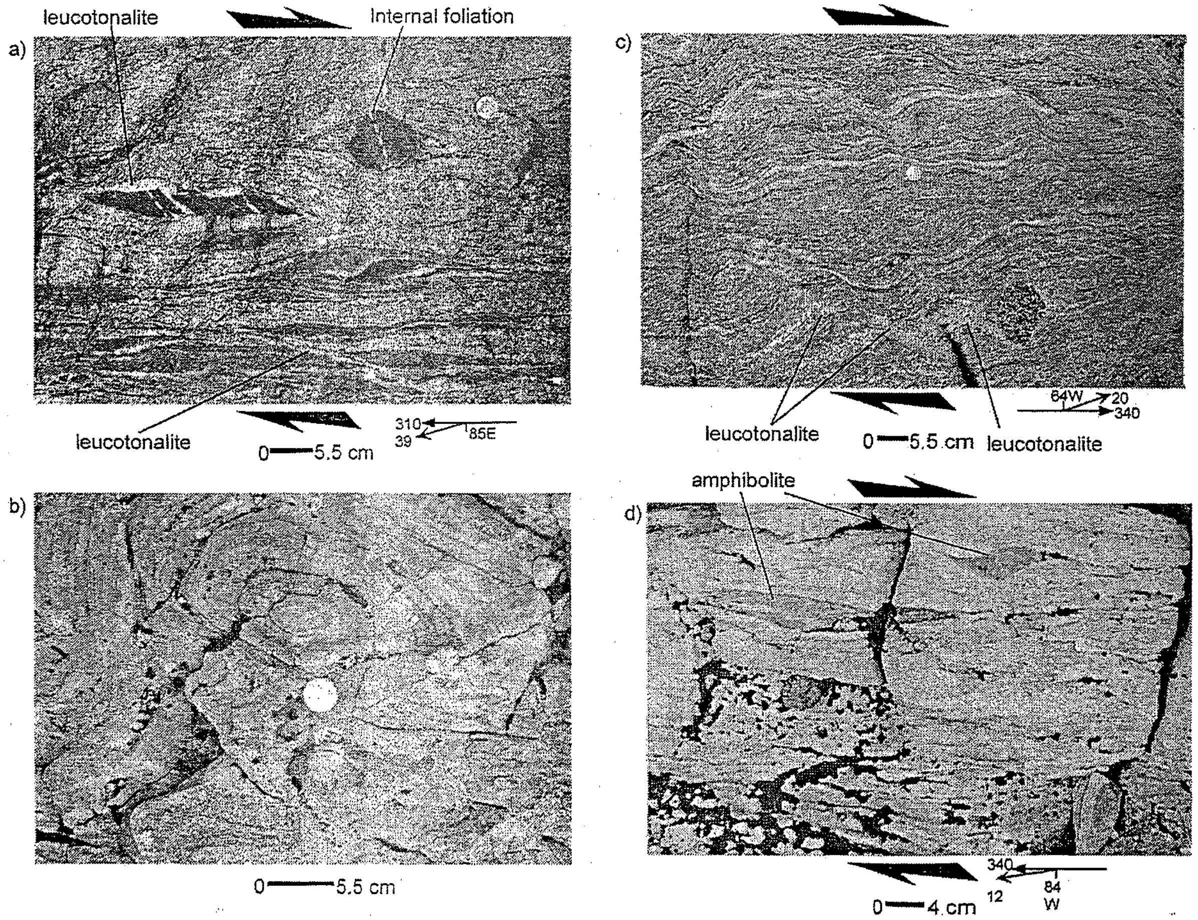

Fig. 5. Outcrop photos of mesoscale structures from the eastern margin of the Quottoon pluton. (a) Field photo of orthogneiss from south of the Skeena River. Amphibolite xenolith above coin with asymmetric tails filled with leucosome indicates dextral shearing. Amphibolite xenolith to the left of the coin is cut by synthetic shears filled with leucosome. An asymmetric calcsilicate nodule below the coin also indicates dextral shearing. Note low angle, synthetic shear band filled with leucosome cutting foliation near base of photo. (b) Cross-sectional view of sheath folds from south of the Skeena River. Sheath fold axes plunge towards the northwest, parallel to the mineral lineations. (c) Field photo of synthetic shears cutting gneissic layering in tonalite north of the Skeena River. Amphibolite xenolith below and to the right of the coin has tails filled with leucotonalite. Shear sense is dextral. (d) Leucogneiss from north of the Skeena River with asymmetric amphibolite clasts. Amphibolite clasts 'floating' in the leucogneiss are interpreted to result from the transposition and boudinage of layers that were part of the original stratigraphic pile.

a kilometer scale F_2 synform. East of these shallow dips towards the Kasiks sill, the gneiss is refolded and transposed into parallelism with the contact of the sill. Thus, the shallow dipping fabrics predate the Kasiks sill (~53 Ma).

West from the F_2 folds, a set of kilometer scale isoclinal folds (F_3) occurs along the eastern margin of the Quottoon pluton (Figs. 2–4b). Similar to the F_2 folds, they fold a differentiated gneissic banding and do not have an associated axial planar cleavage. These folds have steeply east-northeast-dipping axial planes with moderately northwest-plunging hinges (Fig. 4b). F_3 folds have amplitudes of ~2 km and wavelengths of ~1 km, and mineral lineations parallel fold hinges within this region (Fig. 4b). Boudinaged layers of calc-silicate and amphibolite in less competent migmatitic orthogneiss indicate intense stretching parallel to the mineral lineations (Fig. 5a and d). In addition, sheath folds occur and plunge parallel to the mineral lineations (Fig. 5b). Finally, the Quottoon pluton crosscuts F_3 folds along their western side implying they predate 59 Ma (Figs. 2–4b and c).

On the north side of the Skeena River, between the Kasiks sill and the Quottoon pluton, a region of steeply dipping laminated gneiss occurs (Figs. 2–4c). Foliations in this area strike towards the north-northwest and have prominent northwest-trending, moderately plunging mineral lineations (Fig. 4c). Foliations are steep, dipping to the east and west, with west dips dominating. Map-scale folds appear to be absent, although similar paragneiss units occurring across strike suggest large-scale folds may be present. Perhaps the fold hinges are not exposed, or the fabrics in this area completely transpose F_2 and F_3 folds. The similarity of the orientations of mesoscale fold hinges and mineral lineations and the continuity of the foliation trajectories between this region and the region south of the Skeena River suggest this area is the along strike continuation of the same structures (Figs. 2 and 3). This interpretation is supported by the observation that a girdle of poles to foliation from north and south of the Skeena river are nearly identical, suggesting moderately plunging cylindrical structures parallel to the margin of the Quottoon pluton (Fig. 4b and c). The eastern contact of the Quottoon pluton is defined by a low-angle crosscutting relationship in which the gneiss strikes more northerly than the margin of the pluton and is crosscut by weakly foliated tonalite (Figs. 2–4c).

The Quottoon pluton is dominated by steeply east-dipping magmatic and solid state foliations (Figs. 2, 3 and 6a). Magmatic fabrics are present throughout the Quottoon pluton, with subsolidus fabrics occurring in restricted areas along the western margin (Ingram and Hutton, 1994; Metcalf and Davidson, 1997). The magmatic nature of the fabric is attested by the alignment of tabular feldspar and hornblende crystals showing little evidence of crystal plastic strain. A synmagmatic interpretation for these fabrics is confirmed by the presence of numerous centimeter-scale shear bands filled with leucocratic material that is interpreted as melt (lock-up shears of Ingram and Hutton, 1994). An increase in magmatic fabric intensity is found as the western contact of the pluton is approached suggesting a strain gradient is present across the pluton (Metcalf and Davidson, 1997). Numerous aplite dikes, dipping mostly to the west, crosscut the solid state and magmatic fabrics within the pluton and foliations in adjacent country rocks (Fig. 4c).

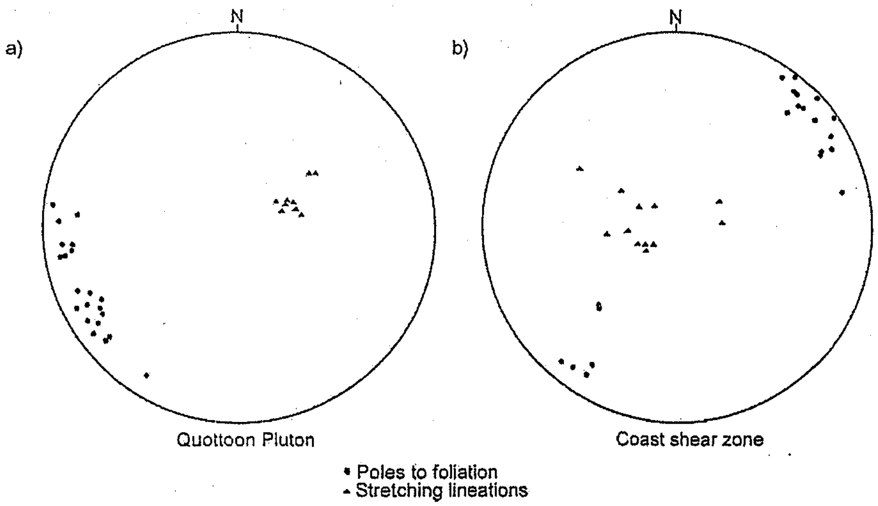

Fig. 6. Stereonets summarizing the orientations of foliations and lineations for the Quottoon pluton (a) and gneisses west of the Quottoon pluton (b) along the northern side of the Skeena River.

The western side of the pluton is subvertical and northwest striking and intrusive into strongly laminated gneiss (Figs. 2–4b). The foliations in this area are steep to vertical, with predominately west dips, and lineations are steep and nearly down dip (Figs. 2, 3 and 6b). Intruded into these gneisses are numerous generations of aplite and pegmatite dikes. Early dikes intruded parallel to the subvertical foliation and are boudinaged. Several generations of moderately east and west dipping dikes occur and are variably strained. Fabrics in the gneisses remain subvertical and west dipping to the eastern margin of the Mid-Cretaceous Ecstall pluton, which is concordant with these fabrics (Figs. 2 and 3).

3.2. Kinematics

Kinematics were determined at the outcrop scale and in thin section by viewing a plane parallel to the lineation and perpendicular to the foliation, consistent with the methods of Simpson and Schmid (1983). In addition, planes perpendicular to the lineation and

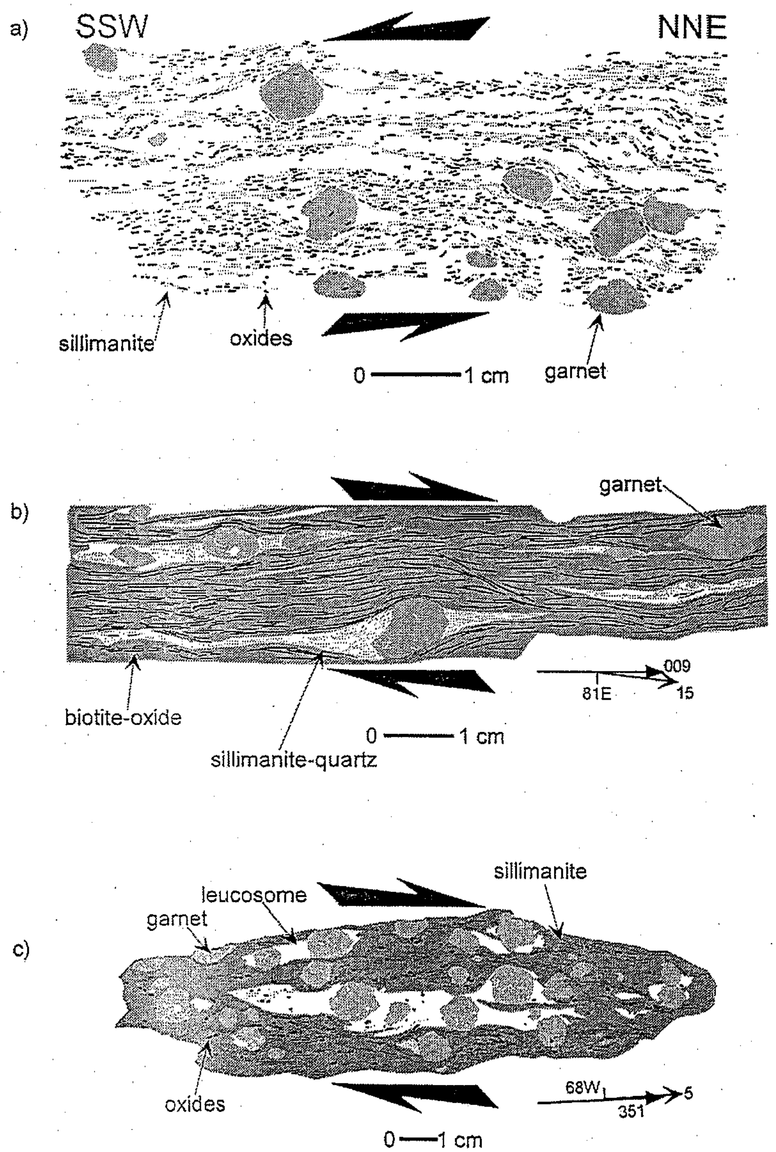

Fig. 7. Sketches of mesoscale structures showing kinematics for the three structural domains. (a) Sketch made from high-resolution scan (600 dpi) of a thin section of paragneiss near the hinge of the F_2 synform shown in Fig. 3. (b) Sketch made from high-resolution scan (600 dpi) of polished slab of paragneiss from steeply dipping fabrics south of the Skeena River. (c) Sketch made from high-resolution scan (600 dpi) of polished slab of paragneiss from steeply dipping fabrics north of the Skeena River.

foliation were checked for kinematic indicators, as this plane may contain kinematic information in a transpressive setting (e.g. Simpson and De Poar, 1993); however, no consistent shear sense was determined in this plane.

Within the area containing the kilometer-scale F_2 folds, samples for kinematic analysis come from locations where the L_2 lineation is strongly developed and where the L_1 refolded lineation was not observed (Fig. 3). To assure that the kinematic indicators were not refolded, the kinematics were determined on both limbs of the map-scale syncline below the Kasiks sill. Asymmetric tails on garnets, shear bands, and asymmetric boudinage are consistently top to the west-southwest on both limbs of the fold indicating penetrative deformation (Fig. 7a). The penetrative nature of the L_2 lineation, stretching parallel to the fold hinges, and no change in shear sense across the fold axial planes suggest F_2 folding was contemporaneous with or predated penetrative top-to-the-west, southwest-directed ductile shearing.

Along the eastern margin of the Quottoon pluton, the gneiss shows evidence of intense ductile shearing parallel to the moderately northwest plunging mineral stretching lineations. Garnet–sillimanite paragneiss contains many features consistent with oblique dextral east-side-up shearing; these include shear bands, pressure shadows around garnet and rotated porphyroclasts (Fig. 7b and c). In orthogneiss and migmatite, porphyroclasts of amphibolite and calcsilicate also indicate a dextral-oblique shear sense (Fig. 5d). Asymmetric boudinage of calcsilicate and amphibolite

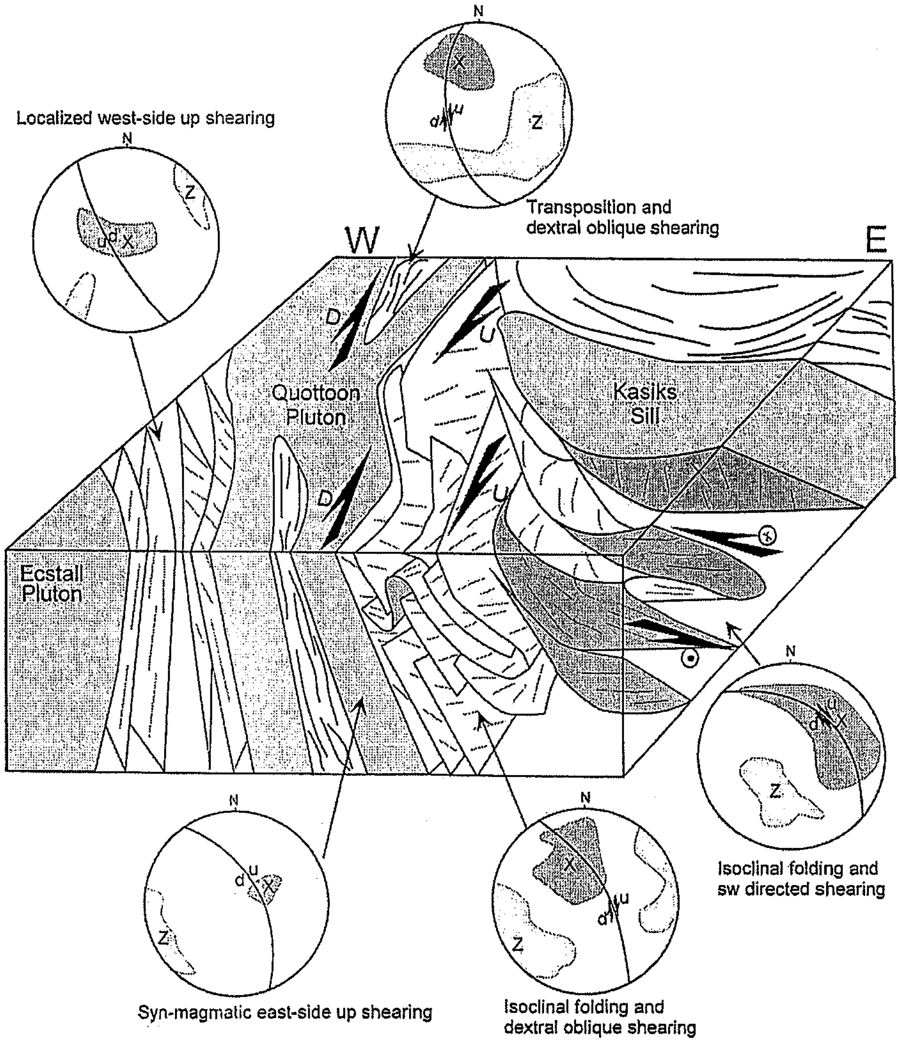

Fig. 8. Schematic block diagram summarizing the geometric and kinematic elements of the study area. Stereonets show the orientation of the finite greatest shortening direction (Z) and finite greatest stretching direction (X) inferred from the orientations of foliations and lineations from the different regions of the study area.

layers within the migmatite resulted in individual layers having been stretched over meters to tens of meters, implying intense stretching during shearing (Fig. 5a and d). The dextral sense of shear within this steeply dipping domain is confirmed at the map scale by the dextral deflection of fabrics on the eastern side of this northwest-striking domain (Fig. 3).

Within a few hundred meters of the eastern contact of the Quottoon pluton, lineations within the pluton are shallower on average than in other portions of the pluton, and shear bands indicating a dextral shear sense occur. In the central portion of the Quottoon pluton, numerous centimeter-scale, melt-filled shear bands occur, indicating an east-side-up shear sense parallel to the steep down-dip mineral lineation. Within this region a synmagmatic shear zone occurs. This shear zone contains numerous enclaves that are deflected and sheared into elliptical shapes indicating heterogeneous east-side-up shear sense (see also Ingram and Hutton, 1994, p. 723). Ingram and Hutton (1994) report similar features along the entire length of the Great Tonalite Sill.

To the west of the Quottoon Pluton Kinematic indicators indicating east-side-up dip-slip displacement occur within steeply dipping gneiss; they include shear bands, asymmetric porphyroclasts and east-dipping dikes displaying an apparent east-side-up deflection of foliation across their walls. These structures are overprinted by structures indicative of west-side-up shearing, the most prominent of which are narrow shear zones and shear bands. The high-angle crosscutting relationship and the localized nature of these shears suggests they formed relatively late in the deformation history of this region. In addition, the numerous west-southwest-dipping aplite dikes that crosscut the Quottoon pluton and adjacent gneisses may also indicate west-side-up shearing during their emplacement. This assumes the dikes were emplaced along tensile fractures that formed during shearing and the poles to the tabular dikes (Fig. 4c) coincide with the instantaneous stretching direction (Anderson, 1951).

In summary, a ~5 km thick (minimum) pile of shallowly dipping, isoclinally folded gneisses that are penetratively deformed by top-to-the-west-southwest shearing occurs on the eastern side of the study area. These structures are overprinted by dextral, east-side-up transcurrent shearing along the eastern margin of the Quottoon pluton producing a steeply dipping zone of refolded and transposed gneiss and migmatite. The Quottoon pluton and gneisses to the west of the pluton are affected by east-side-up, dip-slip shearing and later west-side-up, dip-slip shearing. The region of highly strained, steeply dipping gneiss is approximately 15 km thick. The geometry and kinematics for this region is summarized in Fig. 8.

4. Discussion

The geologic, geometric, and kinematic relationships indicate a polyphase deformation history that was recorded during high-grade metamorphism and plutonism. These data can be integrated into a tectonic model for the evolution of this portion of the Coast Plutonic Complex.

The earliest deformation recorded in the study area was synchronous with formation of F_2 folds and southwest directed shearing. The amplitude and wavelength of the folds imply that the structures record significant shortening (>50% shortening). The parallelism of the fold hinges and mineral lineations, boudinage of the fold hinges, orientations of the large-scale fold axial surfaces and poles to foliations, suggest a large finite east-northeast–west-southwest directed finite stretching direction, and a moderately plunging, northeast–southwest shortening direction for this area (Fig. 8). The geometry of the folds and the kinematics recorded by the rocks suggests that these structures may have accommodated thickening of the crust in a west-southwest directed reverse-shear ductile deformation zone (Fig. 8). U/Pb zircon dates from zircon inclusions within garnet crystals, and zircons from the matrix of the garnet bearing granulites from the northern limb of the F_2 syncline suggest that this deformation was occurring in the time interval 75–65 Ma (Woodsworth et al., 1983).

The western edge of these folds is defined by a dextral deflection of the fabrics into steeply dipping F_3 folds and transposed fabrics along the eastern margin of the Quottoon pluton (Fig. 8). In this area, moderate to shallow plunging mineral lineations indicate predominately transcurrent shearing (Fig. 8). The presence of sheath folds, intense boudinage, parallelism of mineral lineations and fold hinges, steeply dipping north-northwest striking foliations, and isoclinal folds suggests that this region records a shallow to moderately northwest plunging stretching direction, and shallowly northeast–southwest plunging shortening direction and records a large finite strain (Fig. 8).

The map scale deflection of foliation along the eastern side of this region, sheath folds, boudinage, isoclinal folding, transposition of foliation and mesoscale kinematic indicators indicate this area consists of a 2 km thick (minimum) dextral transcurrent shear zone. The low-angle crosscutting relationship between the Quottoon pluton and these structures constrains most of the dextral shearing to be older than 59 Ma based on the U/Pb date of the pluton reported by Gehrels et al. (1991).

Dextral kinematic indicators occur along the eastern margin of the Quottoon pluton. However, throughout the core of the pluton there are numerous synmagmatic kinematic indicators recording east-side-up, dip-slip shearing (Ingram and Hutton, 1994). Magmatic and solid state foliations and lineations within the pluton are consistent with a horizontal northeast–southwest trending shortening direction and steeply east plunging extension direction (Fig. 8). Based on these observations we conclude that the Quottoon pluton intruded during east-side-up, dip-slip shearing, with a dextral component along the eastern side of the pluton (Fig. 8). These conclusions are generally consistent with those of Ingram and Hutton (1994), although they did not recognize a dextral component to the strain.

Gneisses west of the Quottoon pluton are injected by numerous boudinaged pegmatite dikes and have subvertical foliations with steep western dips and down-dip mineral stretching lineations. These features suggest a finite northeast–southwest shallowly plunging shortening direction, with a near vertical extension direction (Fig. 8). Overprinting relationships indicate early east-side-up shearing was followed by west-side-up shearing, consistent with the conclusions of Klepeis et al. (1998) for the Coast shear zone in southeast Alaska.

4.1. Transpression

The geometric and kinematic data for this region can be integrated into a model for partitioned dextral transpression within the high-grade core of the Coast Plutonic Complex. All of the structures documented here record a northeast–southwest trending finite shortening direction (Fig. 8). In addition, all the stages of the deformation record an east-side-up component, with the exception of the final phase of west-side-up deformation to the west of the Quottoon pluton (Fig. 8). The principal variation in the large-scale orientation of the finite strain axis is in the location of the finite stretching direction within each domain (Fig. 8); these variations coincide with the major geometric and geologic transitions of the study area (Fig. 8).

Between the zone of southwest-directed reverse shearing and the dextral shear zone east of the Quottoon pluton, the extension direction switches from moderately east-northeast-plunging to shallow to moderately northwest-plunging while the shortening direction remains northeast–southwest trending but changes from moderate to shallowly plunging (Fig. 8). Shearing parallel to the plunging lineations within the dextral shear zone likely accommodated the east-side-up component imposed on the transcurrent shear zone by southwest-directed reverse movements to the east. These features strongly suggest that the southwest-directed shearing and dextral shearing overlapped in time, with both regions deforming synchronously.

Although the intrusion of the Quottoon pluton mostly post-dates dextral shearing, the occurrence of dextral shears along the eastern edge of the pluton suggest it intruded late kinematically with respect to the dextral shearing. The finite extension direction is inferred to plunge steeply to the east within the pluton, contrasting with the shallow to moderately northwest plunging extension direction inferred for the dextral shear zone (Fig. 8). The finite shortening direction is inferred to be nearly horizontal and northeast–southwest trending within both the pluton and the dextral shear zone. Geometric compatibility is suggested between the two areas because the combined lineations from the two domains define a girdle that is close to the average foliation from either domain.

The features described above could be interpreted in several different ways. One interpretation is that dextral shearing and plutonism substantially overlapped in time, with dip-slip shearing being localized within the pluton, while transcurrent shearing continued in the already mature dextral shear zone. A second interpretation is that the pluton intruded during a change from a dominantly transpressive phase of deformation to one dominated by dip-slip displacements. This second interpretation is favored here because of the crosscutting relationships found along the eastern side of the Quottoon pluton. We suggest that this phase of east-side-up deformation was the terminal deformational event in a long history of transpression involving large dextral shear strains and east-side-up displacements.

The west-side-up displacement west of the Quottoon pluton evolved late in the history of this deformation belt. While the west-side-up displacement does record northeast–southwest shortening, the change in shear sense, the localized nature of the west-side-up shear zones, and the crosscutting nature of the dikes suggests that this deformation is not related to the earlier east-side-up deformation in a simple way. We therefore do not attempt to integrate these structures into the transpressive model.

In summary, we envision a wide deformation belt in which east-side-up reverse shearing on moderately to steeply dipping fabrics occurs synchronously with dextral transcurrent shearing on steeply dipping fabrics (Fig. 8). The eastern reverse sense deformation zone structurally overlies the dextral shear zone and is deflected into the shear zone. Shearing parallel to plunging lineations within the dextral shear zone apparently accommodated the dip-slip component to the strain imposed by reverse shearing to the east. This geometry is interpreted to result from the spatial partitioning of a dextral transpressive strain. Partitioning of the strain is further indicated by variations in the orientation of the finite extension direction that coincides with the major structural and geologic transitions of the study area.

4.2. Implications for orogen-parallel displacement

The likelihood of large orogen-parallel displacements has been viewed with considerable skepticism because structures with the correct kinematics, geometry, age, and magnitude of displacement had not been previously reported within the northern Cordillera (Cowan et al., 1997). Several studies of the Coast shear zone conclude that it records dip-slip displacements related to northeast–southwest shortening and/or the exhumation of the Coast Plutonic Complex (Crawford et al., 1987; Stowell and Hopper, 1990; McClelland et al., 1992; Ingram and Hutton, 1994; Klepeis et al., 1998). However, Stowell and Hopper (1990), recognized transcurrent shearing during the waning stages of deformation. Furthermore, Klepeis et al. (1998) point out that early oblique east-side-up shearing found within the Coast shear zone of Southeast Alaska could be kinematically compatible with transcurrent shearing. We build on these observations and conclude that shortening and dip-slip displacements can be integrated into a model for orogen-parallel displacements.

Irving et al. (1996) concluded that northward translation of the Insular and Intermontane Superterranes would have occurred between 83 and 45 Ma. As discussed above, dextral transcurrent shearing mostly predates 59 Ma and reverse shearing and formation of F_2 folds was occurring between 75 and 65 Ma. Taken together, these dates suggest that much of the deformation east of the Quottoon pluton occurred in the time interval from 75 to 60 Ma. We further point out that intrusion of plutons to form the Great Tonalite Sill began at 83 Ma (Gehrels et al., 1991). Assuming that the deformation history is similar along the entire length of the Great Tonalite Sill, as Ingram and Hutton (1994) suggested, then dextral transcurrent shearing may have already been underway at this time. Thus, we conclude that the timing of deformation in this area occurred within the time period of the proposed large northward translation of the Intermontane and Insular Superterranes (83–45 Ma), consistent with the conclusions of Irving et al. (1996) and Hollister and Andronicos (1997).

The zone of steeply dipping northwest striking foliations described in this study begins at the eastern edge of the Ecstall pluton and continues uninterrupted to 3 km northeast of the eastern margin of the Quottoon pluton, suggesting a thickness of 15 km for the steeply dipping laminated gneisses described here (Figs. 2 and 3). Ramsay and Graham (1970) define a shear zone as a parallel-sided zone of high strain, suggesting that the Coast shear zone in this area is 15 km thick. However, the overall deformation zone we describe continues for at least an additional 6 km to the edge of the map shown in Fig. 2 and an unknown distance further east. The scale of these structures suggests that studies of the Coast shear zone (including our own) have not fully documented the strain gradients into the shear zone leaving the possibility for unrecognized zones of transcurrent displacement to exist.

Several previous studies show that the Coast shear zone west of the Great Tonalite Sill records a high-temperature deformation history during and following the emplacement of the Great Tonalite Sill (Crawford et al., 1987; Stowell and Hopper, 1990; McClelland et al., 1992; Ingram and Hutton, 1994; Klepeis et al., 1998). In these studies, no evidence of transcurrent displacement prior to the intrusion of the Great Tonalite Sill was recognized. This suggests that the large flattening and dip-slip displacements recognized within the Coast shear zone and the Great Tonalite Sill may have erased fabrics recording high temperature transcurrent displacements that predated these structures. Because the eastern side of the Quottoon pluton was not affected as intensely by later deformation, indicated by the strain gradient toward the west through the Quottoon pluton, early structures may be better preserved along the eastern side of the Great Tonalite Sill. However, the large volumes of Eocene plutons and subsequent tectonic activity to the east of the Great Tonalite Sill may have also obliterated evidence for dextral transcurrent shearing (Hollister and Andronicos, 1997). We conclude, based on these observations, that the Coast shear zone extends well to the east of the foliated tonalite sill, that it records an early phase of dextral transcurrent displacement, and that much of the early deformation history of the Coast shear zone may be overprinted by later deformation and plutonism.

5. Conclusions

A multiphase deformational history is recorded within the Coast Plutonic Complex near Prince Rupert, British Columbia. Early structures record west-southwest-directed reverse shearing that produced kilometer-scale east-northeast-plunging overturned folds. A northwest-striking dextral transcurrent shear zone along the eastern margin of the Quottoon pluton deforms these structures; however, deformation within these two domains was contemporaneous, which implies partitioned dextral transpression within this portion of the Coast Plutonic Complex. During intrusion of the Quottoon pluton, dip-slip displacements and northeast–southwest-directed shortening dominated the deformation.

Deformation occurred during the time period from 83 to 59 Ma, within the time period of the large orogen parallel northward translation of the Intermontane and Insular Superterrane. The location and kinematics of the structures described here are consistent with relative dextral transcurrent displacements between the Intermontane and Insular Superterranes. Based on these observations we conclude that these structures accommodated a significant component of the hypothesized Baja B.C. displacement, in which the Insular and Intermontane Superterranes were translated to the north relative to cratonic North America.

Acknowledgements

This work was supported by NSF grant EAR-9526531, the Kraus Memorial Fund, a NSF Graduate Research Fellowship (C.L.A.), and a Geological Society of America Research Grant (C.L.A.). Martin Drury and John Oldow are thanked for critical and constructive reviews of the manuscript. Chris Daniel is also thanked for reading an early draft of the paper. L.S.H. thanks Stefan Schimd and D.H.W. Hutton for providing insights into the structural history of the central gneiss complex. Jim Metcalf, Robert Klee, and Chris Daniel are thanked for their assistance in the field. Keith Klepeis is thanked for many discussions on the nature and origin of the Coast shear zone and Coast Mountains batholith. Chris Kenah is thanked for his well-documented thesis that laid the groundwork for the present work. Members of the ACCRETE team are thanked for all the contributions they have made to this work. Any mistakes, misinterpretations and shortcomings of this paper are the sole responsibility of the authors.

References

Ague, J.J., Brandon, M.T., 1992. Tilt and northward offset of Cordilleran batholiths resolved using igneous barometry. Nature 360, 146–149.

Ague, J.J., Brandon, M.T., 1996. Regional tilt of the Mount Stuart batholith, Washington, determined using aluminum-in-hornblende barometry: Implications for northward translation of Baja British Columbia. Geological Society of America Bulletin 108, 471–488.

Anderson, E.M., 1951. The Dynamics of Faulting and Dyke Formation with Applications to Britain. Oliver & Boyd, London.

Andronicos, C.L., Chardon, D., Hollister, L.S., Gehrels, G.E., Isachsen, C., 1997. Formation of continental crust by magmatic accretion during late orogenic extension. EOS, Transactions, American Geophysical Union 78, F629.

Armstrong, R.L., 1988. Mesozoic and Early Cenozoic magmatic evolution of the Canadian Cordillera. Geological Society of America Special Paper 218, 55–91.

AvéLallemant, H.G., Oldow, J.S., 1988. Early Mesozoic southward migration of Cordilleran transpressional terranes. Tectonics 7, 1057–1088.

Bogue, S.W., Gromme, S., Millhouse, J.W., 1995. Paleomagnetic anisotropy and mid-Cretaceous Paleolatitude of the Outer Island (Alaska) Ultramafic complex. Tectonics 14, 1133–1152.

Brew, D.A., Ford, A.B., 1978. Megalineament in southeastern Alaska marks southwest edge of Coast Range batholithic complex. Canadian Journal of Earth Sciences 15, 1763–1772.

Brun, J.P., Pons, J., 1981. Strain patterns of pluton emplacement in a crust undergoing non-coaxial deformation, Sierra Morena, Spain. Journal of Structural Geology 3, 219–229.

Butler, R.F., Gehrels, G.E., McClelland, W.C., May, S.R., Klepacki, D., 1989. Discordant paleomagnetic poles from the Canadian Coast Plutonic Complex: Regional tilt rather than large-scale displacement. Geology 17, 691–694.

Champion, D.E., Howell, D.G., Gromme, C.S., 1984. Paleomagnetic and geological data indicating 2500 km of northward displacement for the Salinian and related terranes, California. Journal of Geophysical Research 89, 7736–7752.

Chardon, D.H.G., Andronicos, C.L., 1997. The central gneiss complex: an asymmetrical extensional gneiss dome bounded by the Coast shear zone. Geological Society of America Abstracts with Programs, 1997 Annual Meeting 29, A-84.

Cook, R.D., Crawford, M.L., 1994. Exhumation and tilting of the western metamorphic belt of the Coast orogen in southern southeastern Alaska. Tectonics 13, 528–537.

Cowan, D.S., Brandon, M.T., Garver, J.I., 1997. Geologic tests of hypotheses for large coastwise displacements—A critique illustrated by the Baja British Columbia controversy. American Journal of Science 297, 117–173.

Crawford, M.L., Hollister, L.S., Woodsworth, G.J., 1987. Crustal deformation across a terrane boundary, Coast Plutonic Complex, British Columbia. Tectonics 6, 343–361.

Fitch, T.J., 1972. Plate convergence, transcurrent faults and lateral deformation and adjacent to southeast Asia and Western Pacific. Journal of Geophysical Research 77, 4432–4460.

Gehrels, G.E., McClelland, W.C., Samson, S.D., Patchett, P.J., Brew, D.A., 1991. U–Pb geochronology of Late Cretaceous and early Tertiary plutons in the northern Coast Mountains batholith. Canadian Journal of Earth Science 28, 899–911.

Harland, W.B., 1971. Tectonic transpression in Caledonian Spitzbergen. Geological Magazine 108, 793–802.

Holdsworth, R.E., Strachan, R.A., 1991. Interlinked system of ductile strike slip and thrusting formed by Caledonian sinistral transpression in northeastern Greenland. Geology 19, 510–513.

Hollister, L.S., 1975. Granulite facies metamorphism in the Coast Range crystalline belt. Canadian Journal of Earth Sciences 12, 1953–1955.

Hollister, L.S., 1982. Metamorphic evidence for rapid (2 mm/yr) uplift of a portion of the Central Gneiss Complex, Coast Mountains, B.C. Canadian Mineralogist 20, 319–332.

Hollister, L.S., Andronicos, C.L., 1997. A candidate for the Baja British Columbia Fault System in the Coast Plutonic Complex. GSA Today 7, 1–7.

Hollister, L.S., Crawford, M.L., 1990. Crustal formation at depth during continental collision. In: Salisbury, M.H., Fountain, D.M. (Eds.), Exposed Cross-Sections of the Continental Crust. Kluwer Academic, Netherlands, pp. 215–225.

Hutchison, W.W., 1982. Geology of the Prince Rupert–Skeena map area, British Columbia. Geological Survey of Canada Memoir 394, 1–116.

Ingram, G.M., Hutton, D.H.W., 1994. The Great Tonalite Sill: Emplacement into a contractional shear zone and implications for Late Cretaceous to early Eocene tectonics in southwest Alaska and British Columbia. Geological Society of America Bulletin 106, 715–728.

Irving, E., Wynne, P.J., 1990. Paleomagnetic evidence bearing on the evolution of the Canadian Cordillera. Philosophical Transactions of the Royal Society of London A331, 487–509.

Irving, E., Baker, J., Wright, N., Yorath, C.J., Enkin, R.J., York, D., 1995. Magnetism and the age of the Porteau Pluton, southern Coast Belt, British Columbia: evidence for tilt and translation. Canadian Journal of Earth Science 32, 380–392.

Irving, E., Wynne, P.J., Thorkelson, D.J., Schiarizza, P., 1996. Large (1000 to 4000 km) northward movements of tectonic domains in the northern Cordillera, 83 to 45 Ma. Journal of Geophysical Research 101, 901–916.

Kenah, C., Hollister, L.S., 1983. Anataxis in the Central Gneiss Complex, British Columbia. In: Atherton, M.P., Gribble, C.D. (Eds.), Migmatites, Melting and Metamorphism, pp. 142–162.

Klepeis, K.A., Crawford, M.L., Gehrels, G., 1998. Structural history of the crustal-scale Coast shear zone north of Portland Canal, southeast Alaska and British Columbia. Journal of Structural Geology, 20, 883–904.

Lappin, A.R., Hollister, L.S., 1980. Partial melting in the Central Gneiss Complex near Prince Rupert, British Columbia. American Journal of Science 280, 518–545.

McClelland, W.C., Gehrels, G., Samson, S.D., Patchett, P.J., 1992. Structural and geochronologic relations along the western flank of the Coast Mountains batholith: Stikine River to Cape Fanshaw, central SE Alaska. Journal of Structural Geology 14, 475–489.

Metcalf, J., Davidson, C., 1997. Quantitative fabric analysis of the Quottoon pluton: Implications for the late deformation history of the Coast shear zone. Geological Society of America Abstracts with Programs, 1997 Annual Meeting 29, A–277.

Northrop, C.J., Burchfiel, B.C., 1996. Orogen-parallel transport and vertical partitioning of strain during oblique collision, Efjorden, north Norway. Journal of Structural Geology 18, 1231–1244.

Oldow, J.S., Bally, A.W., AvéLallemant, H.G., Leeman, W.P., 1989. Phanerozic evolution of the North American Cordillera; United States and Canada. In: Bally, A.W., Palmer, A.R. (Eds.), The Geology of North America—An Overview. The Geology of North America, Geological Society of America.

Price, R.A., Carmichael, D.M., 1986. Geometric test for late Cretaceous–Paleogene intracontinental transform faulting in the Canadian Cordillera. Geology 14, 468–471.

Ramsay, J.G., Graham, R.H., 1970. Strain variation in shear belts. Canadian Journal of Earth Sciences 7, 786–813.

Robin, P.Y.F., Cruden, A.R., 1994. Strain and vorticity patterns in ideally ductile transpression zones. Journal of Structural Geology 8, 831–844.

Rubin, C.M., Saleeby, J.B., Cowan, D.S., Brandon, M.T., McGroder, M.F., 1990. Regionally extensive mid-Cretaceous west-vergent thrust system in the northwest Cordillera: Implications for continent-margin tectonism. Geology 18, 276–280.

Selverstone, J., Hollister, L.S., 1980. Cordierite-bearing granulites from the Coast Ranges, British Columbia: *P–T* conditions of metamorphism. Canadian Mineralogist 18, 119–129.

Simpson, C., De Poar, D., 1993. Strain and kinematic analysis in general shear zones. Journal of Structural Geology 15, 1–20.

Simpson, C., Schmid, S.H., 1983. An evaluation of criteria to deduce the sense of movement in sheared rocks. Geological Society of America Bulletin 94, 1281–1288.

Stowell, H.H., Hopper, R.J., 1990. Structural development of the western metamorphic belt adjacent to the Coast Plutonic Complex, southeastern Alaska: Evidence from Holkham Bay. Tectonics 9, 391–407.

Symons, D.T.A., 1977. Paleomagnetism of mesozoic plutons in the western most coast complex of British Columbia. Canadian Journal of Earth Science 14, 2127–2139.

Taylor, D.G., Callomon, J.H., Smith, R., Tipper, H.W., Westermann, G.E.G., 1984. Jurassic ammonite biogeographic of western North America. In: Westermann, G.E.G. (Ed.), Jurassic–Cretaceous Biochronology and Paleogeography of North America. Geological Association of Canada Special Paper 27, pp. 121–142.

Tikoff, B., Greene, D., 1997. Stretching lineations in transpressional shear zones: an example from the Sierra Nevada Batholith, California. Journal of Structural Geology 19, 29–39.

Umhoefer, P.J., 1987. Northward translation of "Baja British Columbia" along Late Cretaceous to Paleocene margin of western North America. Tectonics 6, 377–394.

van der Heyden, P., 1992. A Middle Jurassic to Early Tertiary Andean–Sierran arc model for the Coast Belt of British Columbia. Tectonics 11, 82–97.

Ward, P.D., Hurtado, J.M., Kirschvink, J.L., Verosub, K.L., 1997. Measurements of the Cretaceous paleolatitude of Vancouver Island: Consistent with the Baja–British Columbia hypothesis. Science 277, 1642–1645.

Woodsworth, G.J., Loveridge, W.D., Parrish, R.R., Sullivan, R.W., 1983. Uranium–lead dates from the Central Gneiss Complex and Ecstall pluton, Prince Rupert map area, British Columbia. Canadian Journal of Earth Sciences 20, 1475–1483.

Wynne, P.J., Irving, E., Maxson, J.A., Kleinspehn, K.L., 1995. Paleomagnetism of the Upper Cretaceous strata of Mount Tatlow: Evidence for 3000 km of northward displacement of the eastern Coast Belt, British Columbia. Journal of Geophysical Research 100, 6073–6091.

Basin architecture and density structure beneath the Strait of Georgia, British Columbia[1]

C. Lowe, S.A. Dehler, and B.C. Zelt

Abstract: Georgia Basin is located within one of the most seismically active and populated areas on Canada's west coast. Over the last decade, geological investigations have resolved important details concerning the basin's shallow structure and composition. Yet, until recently, relatively little was known about deeper portions of the basin. In this study, new seismic velocity information is employed to develop a 3-dimensional density model of the basin. Comparison of the calculated gravity response of this model with the observed gravity field validates the velocity model at large scales. At smaller scales, several differences between model and observed gravity fields are recognized. Analysis of these differences and correlation with independent geoscience data provide new insights into the structure and composition of the basin-fill and underlying basement. Specifically, four regions with thick accumulations of unconsolidated Pleistocene and younger sediments, which were not resolved in the velocity model, are identified. Their delineation is particularly important for studies of seismic ground-motion amplification and offshore aggregate assessment. An inconsistency between the published geology and the seismic structure beneath Texada and Lasqueti Islands in the central Strait of Georgia is investigated; however, the available gravity data cannot preferentially validate either the geologic interpretation or the seismic model in this region. We interpret a northwest-trending and relatively linear gradient extending from Savory Island in the north to Boundary Bay in the south as the eastern margin of Wrangellia beneath the basin. Finally, we compare Georgia Basin with the Everett and Seattle basins in the southern Cascadia fore arc. This comparison indicates that while a single mechanism may be controlling present-day basin tectonics and deformation within the fore arc this was not the case for most of the Mesozoic and Tertiary time periods.

Résumé : Le bassin de Géorgie est situé dans l'une des régions les plus peuplées de la côte ouest du Canada et où l'activité sismique est très élevée. Au cours de la dernière décennie, les investigations géologiques ont permis de résoudre d'importants détails concernant la structure et la composition de ce bassin peu profond. Toutefois, jusqu'à tout dernièrement, peu était connu des portions plus profondes du bassin. Dans cette étude, de nouvelles informations de vitesse sismique servent à développer un modèle 3-D de la densité du bassin. Une comparaison entre la réponse de la gravité calculée à partir de ce modèle et le champ de gravité observé valide le modèle de vitesse à de grandes échelles. À de plus petites échelles, on reconnaît plusieurs différences entre les champs de gravité du modèle et ceux de terrain. L'analyse de ces différences et la corrélation avec des données géoscientifiques indépendantes fournit de nouveaux points de vue sur la structure et la composition du matériau de remplissage du bassin et celui du socle sous-jacent. Plus spécifiquement, on identifie quatre régions ayant des accumulations épaisses de sédiments non consolidés du Pléistocène et plus jeunes, qui n'ont pas été résolues dans le modèle de vitesse. Leur délimitation est particulièrement importante pour les études d'évaluation de l'amplification du mouvement du sol et des agrégats au large provoquée par les ondes sismiques. On examine la contradiction entre les données géologiques publiées et la structure sismique en dessous de Texada et des îles Lasqueti dans le centre du détroit de Géorgie; toutefois, les données gravimétriques disponibles ne peuvent valider de façon préférentielle l'interprétation géologique ou le modèle sismique dans cette région. Nous interprétons le gradient relativement linéaire, de direction nord-ouest, qui s'étend de l'île de Savory au nord et la baie Boundary au sud comme étant la bordure est de Wrangellia en dessous du bassin. Finalement, nous comparons le bassin de Géorgie avec les bassins d'Everett et de Seattle dans l'avant-arc du sud de Cascadia. Bien qu'un seul mécanisme puisse contrôler la tectonique et la déformation actuelles du bassin à l'intérieur de l'avant-arc, cette comparaison indique que cela n'était pas le cas pour la plus grande partie du Mésozoïque et du Tertiaire.

[Traduit par la Rédaction]

Received 18 February 2003. Accepted 31 March 2003. Published on the NRC Research Press Web site at http://cjes.nrc.ca on 24 June 2003.

Paper handled by Associate Editor F. Cook.

C. Lowe.[2] Geological Survey of Canada – Pacific, P.O. Box 6000, Sidney, BC V8L 4B2, Canada.
S.A. Dehler. Geological Survey of Canada – Atlantic, Bedford Institute of Oceanography, P.O. Box 1006, Dartmouth, NS B2Y 4A2, Canada.
B.C. Zelt. University of Hawaii, School of Ocean and Earth Science and Technology, 1680 East-west Road, Honolulu, HI 96822, U.S.A.

[1] Geological Survey of Canada Contribution 2002078.

[2] Corresponding author (e-mail: clowe@nrcan.gc.ca).

Can. J. Earth Sci. 40: 965–981 (2003) doi: 10.1139/E03-030