GEOLOGIC SETTING OF THE STIKINE TERRANE

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The Western Canadian Cordillera is a collage of crustal terranes, comprising mainly volcanic arc and oceanic assemblages, successively accreted to the continental margin, commencing during Jurassic times. Each terrane possessed its own geologic evolution until accreted. The Stikine Terrane (Stikinia) (Figure 1) represents the largest single block of this collage, covering an area of in excess of 120,000 km2. Its eastern boundary is defined by a set of northerly to northwesterly trending faults (Fraser River-Takla-Ingenika-Kutcho-Nahlin System), its western boundary by the Yalakom fault system and an extrapolated extension northward along the east margin of the Coast Plutonic Complex. These are fundamental boundaries, and likely represent the original configuration of the Terrane, particularly along its eastern boundary. The arcuate trace of the eastern margin of the Stikine Terrane parallels the trend of the Triassic and Jurassic island arcs that may be postulated to have originated from a westerly dipping subduction zone that lay to the east, along the Teslin-Pinchi suture. The understanding of the tectonic configurations that ultimatly caused present geologic framework of the Western Canadian Cordillera is, and will continue to be, one which will give challenge to those who work with the rocks. Subduction zones have been postulated for both sides of Stikinia.

Stikinia is bordered along its eastern boundary by the Oceanic Cache Creek Terrane to the north and south, and the island arc Quesnel Terrane, to the east. The Stikine Terrane contacts the Cadwallader and Bridge River Terranes to the south, and metamorphic and granitoid rocks of the Coast Belt along most of its western boundary. These rocks of the Coast Plutonic Belt may be part of, and form basement to Stikinia. Seismic refraction studies across the central portion of the Terrane indicate that crustal thicknesses south of the Skeena Arch are in the order of thirty-seven kilometers, and to the north, in the Bowser Basin, twenty-nine kilometers. This probably infers the presence of a more granitic-like crust underlying the southern half of the Stikine Terrane than to the north.

The Stikine Terrane consists of Upper Paleozoic to Upper Tertiary rocks, that can be grouped into four tectono-stratigraphic elements; a volcanic island arc assemblage of Late Paleozoic to Middle Jurassic age, a molasse assemblage of Middle Jurassic to early Late Cretaceous age, a transtensional continental volcanic arc assemblage of late Late Cretaceaous to Eocene age, and a final, post orogenic episode of uplift, erosion and plateau basalt volcanism that defines the present geomophology of the terrane, from late Eocene to Present.

The Upper Paleozoic to Middle Jurassic arc-volcanic period represents the interval when the Stikine Terrane evolved as a discrete entity, separated from the influence of adjacent terranes. Upper Mississippian to Permian volcaniclastics, pelite, carbonate basalt and rhyolite of the Stikine Assemblage (Asitka Group) comprise the oldest stratigraphic assemblage of the Terrane. These strata are exposed near the margins, particularly in the northwest corner of the Terrane.

Strata of the Upper Triassic (Karnian to Norian) comprise an assemblage of mainly subaqueous basalt, andesite (commonly with augite phenocrysts), intermediate volcanics, limestone and volcaniclastic sedimentary rocks. They are known as the Stuhini Group in the north, the Takla in the east. These rocks accumulated in a series of thick volcanic piles across the northern and eastern margins of the Terrane. The east-southeast axis of accumulation of these volcanics define the axis of the Stikine Arch. Triassic volcanism along the Stikine Arch possibly evolved in response to a south westerly dipping subduction zone located north of the Stikine Arch. Triassic volcanism along the eastern margin of the terrane appear to have developed in association with rift-like structures. The Triassic volcanics change facies westward into shales, siltstones and greywackes within the ancestral Bowser Basin.

The final episode of arc-volcanism is represented by the Lower to Middle Jurassic (Sinemurian to Bajocian) calc-alkaline volcanics and sediments of the Hazelton Group. These form an arcuate zone along the north east margin of Stikinia, and underlie much of its southern half, where the arcuate trend is no longer apparent. The Hazelton Group is comprised of basalt to rhyolite volcanics and sedimentary rocks deposited in both subaereal and subaqueous environments. Pyroclastic rocks greatly predominate over flows, and a typical lithotype is a reddish to maroon, poorly to unsorted, well bedded, lithic - crystal - vitric lapilli tuff, with lithic clasts of dacite-andesite feldspar porphyry and crystals of feldspar. Four stratigraphic units define the Hazelton Group. Basal unit to the Hazelton Group is a polymictic conglomerate of Sinemurian age or older, containing clasts of limestone, cherts, augite porphyry, granitic rocks and volcanics correlative with the underlying Stikine Assemblage and Takla-Stuhini Groups. The most widespread unit is represented by thick accumulations of non-marine reddish coloured, andesite to rhyolite pyroclastics and flows of Sinemurian to Bajocian age, and known as the Telkwa formation, Toodoggone Volcanics, Coldfish Lake volcanics, Babine shelf facies, Sikanni facies, Bear Lake facies, and the submarine Kotsine facies.

Each of these assemblages is separated by major northwest trending faults. A marine volcaniclastic-tuff assemblage of Pliensbachian to Bajocian age is known as the Nilkitkwa Formation. These interfinger with the Telkwa-Toodoggone equivalents, and change facies westward into the a back-arc ancestral Bowser Basin. The upper formation of the Hazelton Group is an assemblage of shallow marine, very fossiliferous, highly tuffaceous, sedimentary rocks of the Smithers Formation.

Island arc volcanism waned by Middle Bajociam times (Upper Bajocian-Bathonian), with the destruction of the subduction zone. The tightening of the area between the Stikine Terrane and the Craton resulted in the uplift of the marginal arc terranes and adjacent oceanic Cache Creek Terrane, shedding detritus into the Bowser Basin, beginning the molasse stage of the evolution of Stikinia.

The molasse stage comprises two major units, the Bowser Lake and the Skeena Groups. The Bowser Lake Group comprises a suite of mainly marine clastics deposited in delta systems, prodeltic channels and basinal turbidites of late Middle Jurassic to late Late Jurassic (Lower Cretaceous?) age. The Skeena (Sustut) comprises a suite of nonmarine and marine paralic clastics. They are of mid Lower Cretaceous (Hauterivian) early Upper Cretaceous (Cenomanian) age, deposited off an uplifted terrane to the east, the Omineca Crystalline Belt.

Deposition of the Bowser Lake Group was centripital along the north, east and south part of the Bowser Basin, and appears to be longitudinal-southward, in the western part of the basin. Clastic deposition in the north, off the Stikine Arch was characterized by a flood of cherts as thick, conglomeratic channel fills indicating both emergence of the Cache Creek Atlin Terrane and major subsidence along the northern boundary of the Basin. In contrast, off the southern margin of the Bowser Basin, detritus was entirely volcanic and granitic debris derived off the Skeena Arch from the Stikine, Takla, and Hazelton strata and coeval intrusives. Deposition was controlled by northwardly prograding deltaic assemblages of much lower energy deposition than was apparent to the north. Conglomerates are significant only in the basal Bowser Lake beds along the Skeena Arch.

By mid Early Cretaceous time, the Stikine Terrane became effectively part of the Craton. Regional uplift of the Terranes to the east resulted in a regional change in sediment transport direction, and detrital provenance. The Skeena Group (Sustut, Jackass Mountain and Pasayten Groups) sediment transport direction was to the southwest, across the southern two-thirds of Stikinia, and likely continued across the present trace of the Coast Crystalline Complex. Clasts of the Skeena comprise cherts and volcanics, reworked from underlying strata, as well as significant quantities of muscovite, quartz and quartzite. This metamorphic detritus signaled the emergence of the Omineca crystalline terrane to the east. The net effect of deposition of the Skeena assemblages resulted in a peneplanation of much of the Stikine Terrane. Lower Cretaceous volcanics of the Gambier Group are exposed along the southwest margin of Stikinia, and trend southwards, across the southern Coast Mountain, inferring linkage of the Stikine Terrane with those Terranes to the west at least by Early Cretaceous times.

The transition from the molasse assemblages of the Bowser-Skeena assemblages to a transtensional, continental arc assemblage was coincident with the beginning of emergence of the Coast Plutonic Complex, and possibly in response to the impingement of the craton onto the Wrangel-Alexander Terranes. These volcanic assemblages include the mid Cretaceous to late Late Cretaceous Kasalka and Kingsvale Groups, and Paleocene to Eocene Ootsa Lake Group and Eocene-Oligocine Endako Group. The subduction zone that spawned these volcanics likely lay to the west. The transition from paralic Skeena sediments to continental arc volcanics is marked by a dramatic restrictions in the sedimentary basin, eruption of alkali augite basalt across the Skeena Arch, eastward directed thrust faults along the east flank of the Coast Plutonic Complex, and deposition of a coarse clastic red bed assemblage fed from the west, and underlying much of the Upper Cretaceous-Paleocene volcanic assemblages.

The transtensional continental arc assemblage comprises a suite of mainly calc-alkaline volcanics deposited in discrete, down-drop volcanic basins. The oldest suite is characterized by the (mid to Upper Cretaceous), Kasalka Group, deposited across the Skeena Arch in a series of caldera-like structures. These are basalt to rhyolite, mainly intermediate in composition. These volcanics were deposited unconformably relationship on the underlying Skeena. The younger Ootsa Lake Group (dominantly Eocene) is much more widespread, extending across most of the south half of Stikinia, and intermittently across the eastern and northern part, where they are correlative with the Sloko Group. The terminating phase of volcanism is marked by basaltic volcanism of the Endako Group, deposited in basins along the southeastern part of the Terrane. Drainage patterns shifted dramtically from a southwestern to an easterly and southwesterly longitudinal trend.

The Oligocene to Present internal is a post orogenic episode marked by regional uplift, developement of a basin and range morphology, rapid uplift of the Coast Plutonic Complex, and stream capture from major rivers rapidly down-cutting through the uplifting Coast Belt. Basin and range morphology is best developed across the Skeena Arch. In the southern part of the Terrane, the interval is marked by eruption of the Chilcotin plateau lavas, and the east-west trending Anahim shield volcanoes. That the process is still in progress is evidenced by the easterly younging ages of the Anahim volcanics, indicating the westward migration of the Craton across a still active hot spot.