The poster is organized as follows: (1) At the top, just below, a summary relates plate tectonics to mountain building. (2) To the right are three maps whose features must be accounted for in any attempt to show how the Canadian Cordillera formed. (3) Below, a scale with major divisions of time is keyed to a series of geological maps that locate surface exposures of rocks of different ages. (4) Keyed to these in the lower half of the chart, "three-dimensional" cartoons and texts use plate tectonic concepts to suggest how Canada's western mountains may have evolved.

Plate tectonics and mountain building

Earth is armoured by an outer shell of rigid lithospheric - or tectonic - plates that range in thickness from near 0 to about 150 kilometres. Most plates consist of both oceanic and continental lithosphere; a few are just oceanic lithosphere. Plates are constantly in motion relative to one another. They grow by addition of mantle-sourced basalt at oceanic spreading ridges, called divergent plate boundaries, lose heat and become denser as hev move laterally across the ocean floors, and eventually become so dense that they sink into the mantle beneath other plates along subduction zones at convergent plate boundaries. No ocean floors are older than about 180 million years. In contrast with the ocean floors, the less dense, buoyant continents are not subducted, but instead are moved around Earth's surface by the constantly growing and disappearing oceanic conveyer belts. Because they are not subducted, the continents are repositories of up to 4 billion years of Earth's history. Divergent and convergent plate boundaries are connected in various ways - "transformed" - at transform plate boundaries, places where plates move past one another on great faults. All three kinds of plate boundary occur today off Canada's western coast, as shown on the first map to the right.

Distinctive associations of rocks form along each type of plate boundary, and also in an additional type of boundary found today where the eastern North American continent abuts the floor of the western North Atlantic Ocean within the North American Plate, whose eastern boundary is the mid-Atlantic spreading ridge. If we follow the old adage that "the present is the key to the past" and can identify comparable associations in the rock record, we can learn something about ancient plate tectonic activity. Evidence of all four types of boundary can be found in the rock record of the Canadian Cordillera. The natures of those boundaries and how they have changed through time tells us how the Canadian Cordillera formed.

Mountains originate in three basic ways. First, mountainous regions, sometimes called "rift-shoulders", form at divergent margins when parts of continents arch upward, rift, drift apart and become separated by new oceanic lithosphere. Such mountains, nearly 2000 metres high, are found today on Baffin Island in northeastern Canada and formed when Greenland drifted away from Canada <63 million years ago. Such mountains may

have existed some 600 - 700 million years ago in the region that eventually became the

Neogene

Cordillera. Then, a supercontinent rifted apart and the pieces became separated by an ocean basin that was the far-distant ancestor of the Pacific Ocean. The continentocean boundary that formed then became the birthplace of the Cordillera some 400 million years later. Second, mountains are made when eruption of lava and ash builds up volcanoes, as exemplified by the Cascade Range of active and dormant volcanoes, some over 4000 metres high, that extends from southwestern British Columbia to northern California. Third, the greatest mountain chains on Earth today, the Alps, Andes, Himalayas and North American Cordillera, sometimes called "fold mountain

Plate convergence leaves a strong record because it can generate voluminous volcanic and plutonic rocks in the overriding plate, about 100 kilometres above the subducting plate and also heats and weakens the lithosphere, metamorphosing rocks in the plate margin and making them easy to deform. Plate convergence does not necessarily lead directly to formation of great mountain belts - something else is required. Plate convergence started along the pre-Cordilleran margin about 390 million years ago, but events leading directly to the Cordillera of today started some 200 million years later. The Pacific Ocean basin is surrounded by volcanoes of the arcuate (in map-pattern) chains of volcanic islands ("island arcs"), big ones such as Japan and the Philippines, and numerous smaller ones, are separated from the continent of Asia by small ocean basins such as the Japan Sea. By contrast, the eastern Pacific is rimmed by the mountains of the Andes and Cordillera, some over 6000 metres high, featuring continental arc volcanoes. Why the big difference on or "rollback" of the oceanic lithosphere as it turns down to sink into the mantle at subduction zones, exceeds the rate of advance of the overriding Eurasian plate, thus moving the island arc eastwards away from the continent. Contrarily, along the so that in effect the advancing North and South American continents collide with the

Evolution of Canada's western mountains

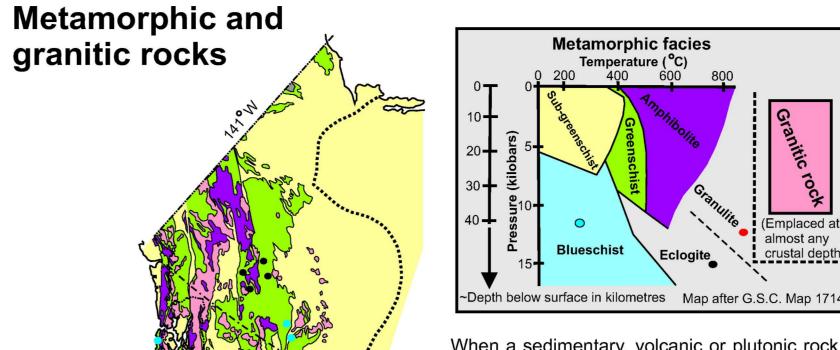
Physiographic divisions an Plains comprise all three possible types of plate boundary. Cascade Mts

Highest summits Longitudinal ▲ ML Mount Logan 5959 m ions A MR Mount Robson 3954 m ▲ MW Mount Waddington 3994 m

This map locates major physiographic features of the Canadian Cordillera and adjacent parts of Alaska, which comprise a mountainous Eastern System; an Interior System with more subdued topography; and a mountainous Western System. The Eastern and Western systems are subdivided by longitudinal depressions. The systems contain a variety of features whose names mostly are well known, such as the Rocky Mountains. Interior Plateaus and Coast Mountains.

The present topography is geologically young. The latest uplift of the Rocky Mountains possibly was in the last 20 million years, that of the southern Coast Mountains was in the last 10 million years, and the Saint Elias Mountains - the highest in Canada - were raised in the last 5 million years. For the most part, the three systems generally reflect the locations of much older bedrock features formed when the ancestral Cordilleran mountains first were raised between about 185 and 60

The map also shows the present distribution of lithospheric plates in the region. The Cordillera is built on the western margin of the North American Plate, which extends eastward from the toe of the continental slope as far as the mid-Atlantic Ridge. West of this, the Pacific Ocean is floored by the Pacific Plate - the largest on Earth - that moves northward to subduct beneath Alaska, and by the small Juan de Fuca Plate which is subducting beneath southwestern British Columbia. The Juan de Fuca spreading ridge, on which plates move apart, the Cascadia subduction zone, on which plates come together, and the Queen Charlotte transform fault, which links the Cascade subduction zone with the Aleutian subduction zone, south of Alaska.



Triassic

When a sedimentary, volcanic or plutonic rock is subjected to temperatures and pressures very different from those under which the rock formed, new, metamorphic minerals grow. We know from laboratory studies the temperatures and pressures under which many metamorphic minerals are stable. Associations of such minerals that indicate temperature/ pressure stability fields are "metamorphic facies". By identifying the metamorphic facies of a rock, we can estimate the depth in the crust at which the rock was metamorphosed, and thus the amount of later uplift needed to expose it at surface.

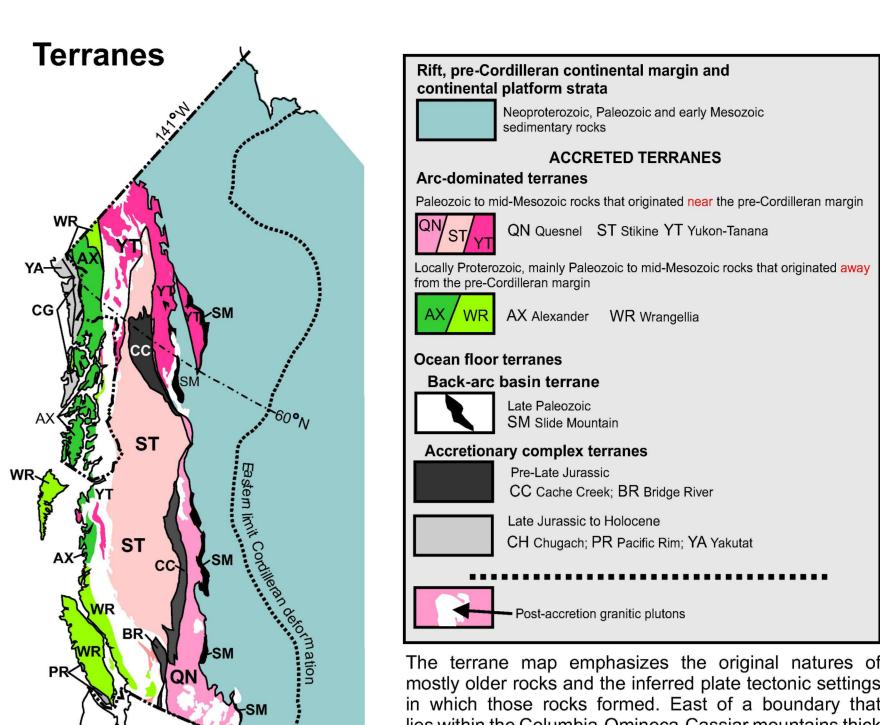
The map shows two continuous belts of mostly amphibolite and greenschist facies, one in the Columbia-Omineca-Cassiar mountains in the east, and the other in the Coast Mountains in the west. They merge in Yukon and come close together near the 49th parallel of latitude. A third, more discontinuous belt is close to the Pacific coast. The higher grade metamorphic rocks are flanked, in the Rocky Mountains, Interior Plateaus and Insular Ranges by rocks of mainly subgreenschist facies. It appears that rocks in the Columbia-Omineca-Cassiar mountains, the Coast Mountains, and locally along the Pacific Coast, were more deeply buried, then uplifted by greater amounts than those in flanking regions. Why?

Permian

Permian and

Carboniferou

Any story of Cordilleran evolution must attempt to account for these differences. From the terrane map to the right, it appears that most high-grade metamorphic rocks are located in just those regions where the inner (pink) terranes tectonically overlapped rocks deposited on outer parts of the old continental margin, and where inner (pink) and outer (green) terranes come together, suggesting that deep burial and later differential uplift is related to



500 km

Late and Middle

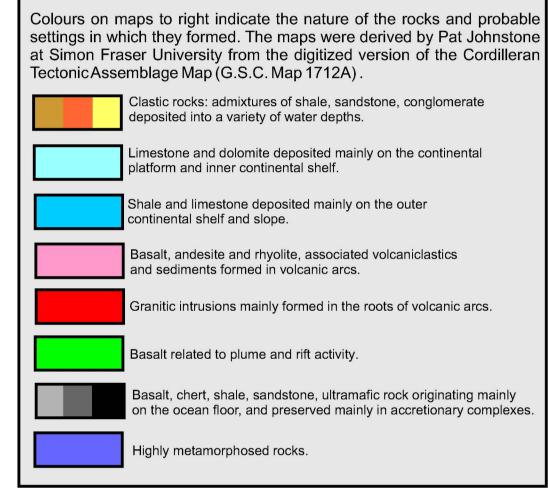
West of this, the mostly late Paleozoic and early Mesozoic rocks can be grouped into regionally extensive, fault bound "terranes" made of igneous and sedimentary rocks. Each terrane has a geological record of deposition, extrusion and intrusion that differs from the records of adjacent terranes and from that of rocks laid down on the old continental margin. Furthermore, the fossil content and magnetic signatures may be different in rocks of the same age in different terranes and from old continental margin deposits, which suggests that the terranes formed somewhere other than where they are found today embedded in

Most big terranes are remnants of island arcs, formed above subduction zones along convergent plate margins. They comprise volcanic rocks, related granitic intrusions, and associated, mainly marine, sedimentary rocks. The arc rocks are accompanied by highly broken and disrupted rocks that overlap in age with them, and were scraped off the ocean floor and accreted to the overriding plate during subduction; these are called accretionary complexes. The isotope chemistry of older terranes shows that most contain little material

one another, at the time they formed, mostly are uncertain. Several methods are used to try to locate terrane "homelands" and the paths terranes may have followed to arrive in their present locations. Although reconstructions of positions of oceanic plates relative to the western North American plate margin are made back through Cretaceous time from "mirror images" of linear magnetic anomalies on the Pacific Plate, other methods faunas of the same age, using paleomagnetic studies to determine paleolatitudes at which terranes were located at various times relative to the continental interior, and determining isotopic ages of detrital zircons - grains in Cordilleran sandstones - whose ages may link

shortening by folding and thrust faulting of the rocks in the Cordillera.

Geological time-scale and surface distribution of rocks of different ages

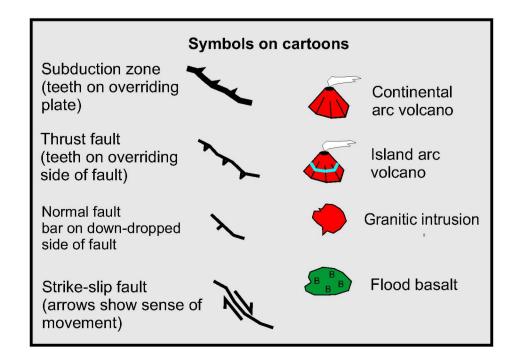


Cordilleran evolution

The "3-D" cartoons on the right show stages in the evolution of the Canadian Cordillera interpreted within a plate tectonic framework. Components of the cartoons, at surface and at depth are (1) westernmost parts of the pre-Cordilleran continent - both old continental crust and overlying strata - and (2) terranes foundations of the western Cordillera - whose present locations are on the map at the top right of the chart. Additional symbols

Because many older parts of the geological record have been overprinted, obscured and obliterated by younger events, the left-to-right order of the cartoons is from the present, where the greatest amount of information is available, back through time, with decreasing amounts of information and increasing amounts of uncertainty. Most major structures on the cartoons can be identified as far back in time as about the Middle Jurassic; older ones are largely conjectural. Cretaceous through Middle Jurassic relative plate convergence directions, indicated by heavy arrows on the ocean floor, are based on the sense of relative movement recorded mostly by strike-slip faults within the Cordillera. For most of the time, the dips of subduction zones evidently were towards the continent, because with two exceptions, accretionary complexes are not known continentward of contemporary arcs. The exceptions are in the Permian for at least the northern Cordillera, and, possibly, for the Early Jurassic Stikinian arc.

In reality, there is probably far more of a continuum in Cordilleran devolution than in the cartoon sequence, where time-telescoped events in each stage create jumps between stages. Major changes, in Middle and Late Devonian time, and at the end of the



cartoons should be sought within the context of the

belts", were made when lithospheric plates both converged and collided.

"ring of fire" that form above the subducting ocean floor. In the western Pacific, different sides of the ocean? It seems that in the western Pacific, the rate of retreat, eastern Pacific margin, the rate of advance of the overriding North and South American plates is greater than the rate of rollback of the subducting oceanic plate,

Cretaceous

Cretaceous, Late and

Middle Jurassic

 Ω

accretion of terranes to the old continental margin.

Paleozoic

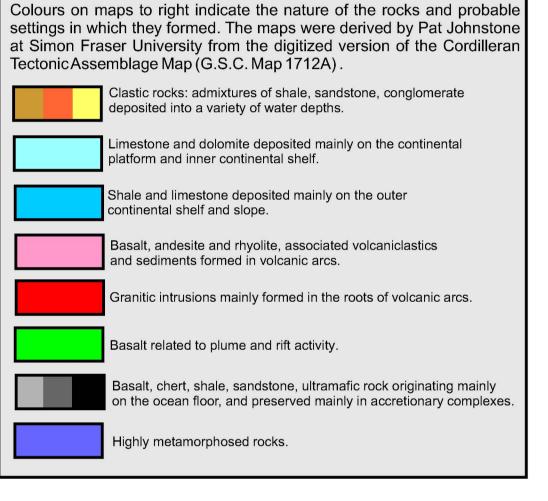
Devonian

lies within the Columbia-Omineca-Cassiar mountains thick deposits of sedimentary rock were laid down along the within-plate continent-ocean boundary - the old, pre ordilleran continental margin - formed some 600-700 million years ago when a supercontinent split apart. The deposits can be traced eastward into much thinner strata laid down on the continental platform.

ACCRETED TERRANES

CC Cache Creek; BR Bridge River

Terranes are the "foundations" of the western Cordillera. The inner terranes were added



The heavy purple lines on the cartoon are the physiographic boundarie

shown on the left-hand map at the top of the chart. Eastern and Western

systems were last differentially uplifted relative to the Interior System in

the Neogene; subsequently all were eroded to create today's physiography

The North American Plate is bounded in the south by the young an

into the mantle along the Cascadia subduction zone. About 100 km above

it, in the overriding North American Plate, is the Cascade magmatic arc

whose older parts are Paleogene. Behind the arc. flood basalt may be

"leaked" from upwelling asthenospheric mantle shown in the cross-section.

Farther north, the North American Plate is bounded by the offshore Queer

Charlotte transform fault, whose continuation in Alaska is the Fairweather

Fault, East of it in the northern interior of the Cordillera, mantle-sourced

mainly basaltic volcanic rock may have surfaced along fractures caused

West of the transform, the enormous Pacific Plate moves northward to

it is the 4000 km long Aleutian-Wrangell island arc (in the west) and

continental arc (in the east). The eastern tip of the arc is in the Saint Elias

Mountains of southwestern Yukon. The mountains there, the highest in

Canada, are located on the transition from transform to convergent plate

boundaries. The mountains were jacked up in about the last 5 million years

by wedging beneath the margin of the North American Plate grea

thicknesses of sediment eroded from the continent and carried northward

All world maps modified from Scotese, 1994.

AF Africa; AN Antarctica; Au Australia; BA Baltic

IN India: NA North America: NC North China:

SA South America; **SC** South China; **SI** Siberia.

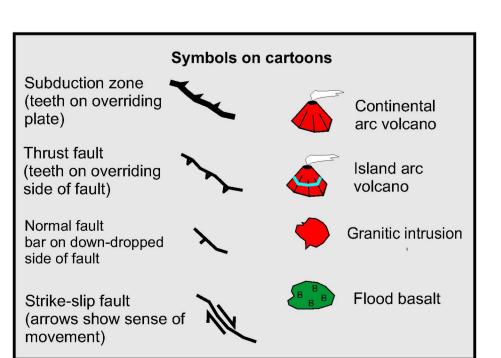
ed line of varying weights = Cordilleran margin.

on the Pacific Plate. The off-scraped sediment forms Yakutat terrane.

by movement of the transform fault.

Neogene

Early Jurassic, are probably linked to big changes in global plate



In a planet whose surface features are controlled by plate tectonics, possible causes of the changes depicted in the entire global system of interacting plates. Here, selected global paleogeographic maps are included and may be of help explaining some of the changes.

Paleogene

Time, in millions of years before the present

Paleogene

Cenozoic

continental crust and margin

rocks and components of the

upper mantle in the cross-section

pased on the Southern Canadian

ordilleran Lithoprobe interpretation

Hammer and Clowes, 200

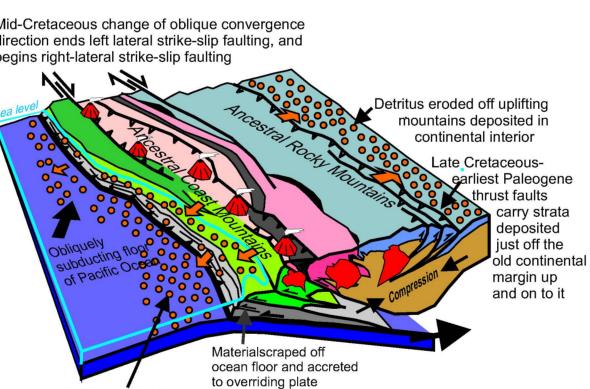
ote: 5X vertical exaggeration)

Right-lateral strike-slip faulting (west side moves north)

and deposited on the ocean floor About 55 million years ago, in the early Paleogene the Cordillera started to acquire something like its present configuration. It underwent "transtension" a word meaning synchronous pulling apart and sideways sliding. In southerly parts of the Cordillera much of the crust was stretched, pulled apart and thinned. At about the same time, parts moved northward for hundreds of kilometres relative to the continental interior on great right-lateral strike-slip faults such as the Tintina, Northern Rocky Mountain Trench, and Denali faults in the north, and the Fraser Fault in the south. Transtension widened the mountain belt, thinned the crust, and probably tectonically lowered the surface of much of the Cordillera. The change from the previous interval, where transpression was important, may have required only slight changes in the direction of oblique convergence between continental and

Arc-related magmatism persisted along what became the eastern Coast Mountains and in the southern interior until about 45 million years ago About 40 million years ago, and not shown above, an intraoceanic spreading ridge, separating the northward moving Kula Plate to the north from the eastward moving Farallon Plate to the south, intersected the North American plate margin somewhere near Vancouver Island. South of the intersection was a convergent margin, above which older parts of the Cascade magmatic arc were generated. North of it, the North American plate margin evidently was temporarily coupled to northward-moving oceanic plates. Detritus eroded from the Cordillera was deposited eastward across the continental interior, into interior fault-bound basins, and westward on to the floor of the Pacific.

Late Cretaceous - earliest Paleogene



deposited on ocean floor By the mid-Cretaceous, some 100 million years ago, almost the entire Cordilleran region had been raised above sea-level and incorporated all major terranes. It was narrower, probably higher, and had thicker crust than the present Cordillera. In the eastern Cordillera, strata laid down on the old continental margin were folded and thrust eastward up and over the edge of the old continent to form the ancestor of the present Rocky Mountains. mountains were transported eastward and deposited across the continental interior. In the west, Wrangellia and Alexander terranes became firmly welded to the previously accreted inner terranes by about 100 million years ago, concomitantly with on-going arc-related magmatism. This process made the ancestral Coast Mountains, parts of whose crust was raised by over 10 km between 95 to 85 million years ago.

The entire region was undergoing "transpression", that is, it was being laterally compressed, causing folding and thrust-faulting in the rocks and so thickening the crust, while at the same time parts moved northward relative to the continental interior on rightlateral strike-slip faults. Compression probably was due to the North American Plate moving so rapidly towards the ancestral Pacific basin that the oceanic floor was unable to subduct fast enough to avoid colliding with the overriding plate. In the mid-Cretaceous, the North American Plate started to move west southwestward rather than northwestward. This change this may have been at least partly responsible for the widespread switch to right-lateral strike-slip faulting in the margin of the North American

deposited on oceanward parts of the old continental margin This was the oldest known event leading directly to the first specifically Cordilleran, mountains. Shortly after, Stikine terrane was thrust eastward beneath Cache Creek terrane The crust of the region that eventually became the Columbia-Omineca-Cassiar mountains was thickened, i surface was uplifted above sea level and eroded. T products of erosion were deposited first to the west on to Stikine terrane and then to the east into the region that became the Rocky Mountains. These events were takin place at the same time as the ocean floor was subducting beneath the margin, heating and weakening the crust, and generating volcanoes and granitic intrusions along th western margin of the North American Plate. What caused the big change? It seems that in the Middle Jurassic, when rapid spreading of the North Atlantic ocea

At the end of Early Jurassic time, some 185 million years

ago, Quesnel terrane was thrust eastward over rock

Early Cretaceous - Middle Jurassic

nountains and deposited in interior basins

initiation of left-lateral

floor started, the North American Plate moved rapidly northwestward, ploughing into and accreting to the old continental margin the complex of arcs and accretionary complexes that lay offshore. By the end of Middle Jurassic time, about 165 million years ago, Alexander and Wrangellia terranes can be linked to Stikine terrane. The oceanward advance of the North American Plate probably was so rapid that the hot, weak lithosphere of its leading edge in effect collided with the ocean floor, piling up mountains. In addition northwestward movement of North America may have caused oblique subduction - as seen LATE JURASSIC ~160 Ma today in Sumatra - that resulted in left-lateral strike-slip faulting in the overriding plate and southward displacement of those parts of the

emerging Cordillera that lay

oceanward of the faults.

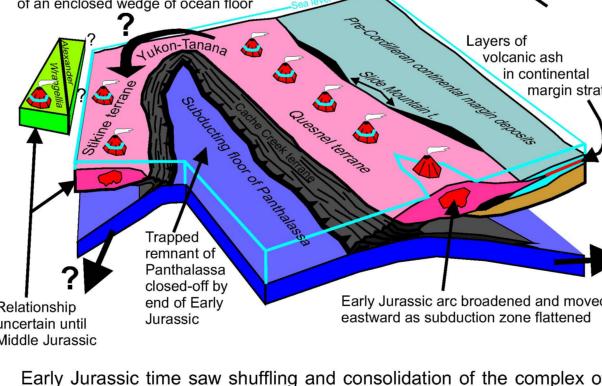
Early Jurassic Counterclockwise rotation of Stikine and (part) Yukon-Tanana terranes may account for their positioning west

Mesozoic

Early Jurassic

and Triassic

Jurassic



arcs and accretionary complexes that was loosely assembled off the northwestern margin of what eventually became North America. In Quesnel terrane, the axis of the island arc migrated eastward, the arc broadened, and for the first time since the Devonian, volcani ash was interbedded with sediment deposited on the edge of the old continent, indicating proximity of the arc to the continent. What caused the change? At this time, rifting on the other side of what was to become North America is related to break-up of Pangea, that i the Middle Jurassic led to rapid spreading of the North Atlantic basin It may be that arc broadening is due to flattening of the subduction zone as the North American Plate started its long migration towards the ocean on its western margin and Panthalassa started to decrease in size and eventually became the Pacific Ocean.

In the Early Jurassic. Stikine terrane lay west of Cache Creek terrane. It is not clear whether this is happened because the Stikiniar segment of the Quesnel - Yukon-Tanana - Stikine arc system ro into this position, as shown in the cartoon, or whether it moved in position along strike-slip faults, or both. What is clear is that a slive of the floor of the great ocean called Panthalassa and represent by youngest, Early Jurassic parts of Cache Creek terrane, somehow became enclosed between Quesnel and Stikine terranes.

Much of this activity probably took place up to about 1000 kilometre south of the present location of these rocks relative to the continenta interior. The location of Alexander and Wrangellia terranes at thi time is not certain, although by latest Triassic time an arc was active EARLY JURASSIC ~180 Ma on Wrangellia. Just possibly, this ar was an extension of the Stikine and Quesnel arc-system

volcanoes, granitic intrusions and related sediments, lay of the old continental margin. The arc system, at least that part represented by Quesnel terrane, faced westward toward the ocean, with the subduction zone dipping eastward beneath it. The arc was built on folded and thrust older parts of the older inner arc terranes and on Slide Mountain terrane. Behind the Triassic arc, a basin contained sand and much eroded both from the arc to the west and from the continent o the east, hinting that by the Triassic and following Permo

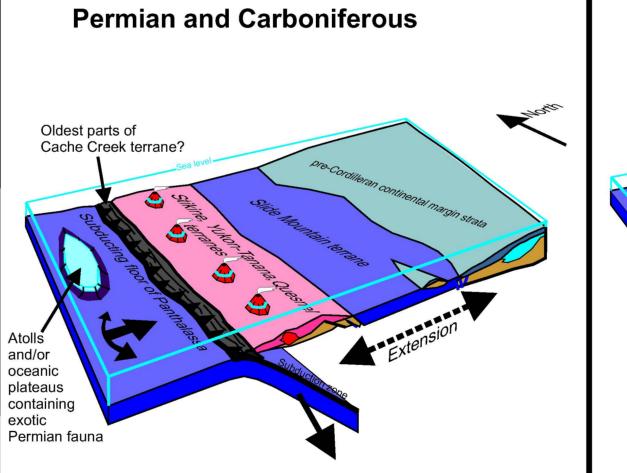
Triassic deformation, the arc system was much closer to the continental margin than previously. However, unlike in the Early Jurassic, no volcanic ash was blown eastward on to the old continental margin, hinting that the arc volcanoes still lay some distance from the margin (or else wind directions were Cache Creek terrane is the remains of an early Mesozoic

accretionary complex - offscrapings of the floor of Panthalassa - which accompanied the arc. It is distinctive in that it contains enormous masses of limestone - forme atolls and oceanic plateaus - with fossils like those found today in parts of Asia. The terrane contains Late Triassic and Early Jurassic blueschist, a metamorphic rock formed under the unusual conditions of high pressure but low temperature found in upper parts of subduction zones.

and locally non-marine basalt, akin to continental flood basalt, but which appears to have been extruded rapidly in an oceanic setting, perhaps above a mantle plume like the volcanie rocks of the present Hawaiian Islands.

Wrangellia at this time contains a great thickness of marine

The rocks in all of these terranes appear to have formed south of where they are today, relative to the continental interior.



At the beginning of the Carboniferous, the inner terranes became established as discrete entities. The arc system that formed in Devonian time on outer parts of the old margin became separated from it by a back-arc basin floored by oceanic lithosphere, which forms Slide Mountain terrane.

Oceanward of the basin, island arcs, represented by older

igneous and sedimentary rocks in Quesnel, Yukon-Tanana

central Asia, and unknown east of Cache Creek terrane.

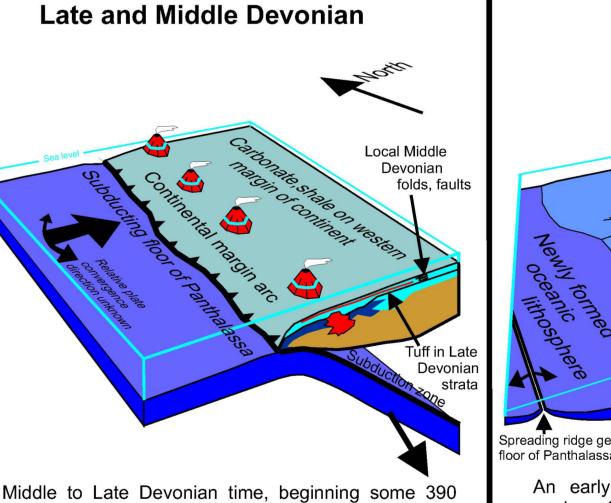
They may have lived in western tropical Panthalassa; later,

and Stikine terranes, are partly founded on pieces of spalled off continental margin and partly (possibly) on old ocean floor The tectonic setting was probably similar to today's western Pacific basin. The direction of subduction was temporarily reversed at least in the north in the Permian, as happens today in Taiwan and the northern Philippine Islands. The inner arc terranes appear to have formed south of where they are today relative to the continental interior, at tropical latitudes in eastern Panthalassa. Permian faunas in Cache Creek terrane are like faunas of the same age in eastern and

their remains were carried on moving oceanic plates across Panthalassa and accreted in early Mesozoic time. This system of arcs and marginal basins formed as almost all continents amalgamated into the supercontinent called Pangea, leaving a single enormous ocean called Panthalassa

Wrangellia and Alexander terranes, linked by arc-related plutons in the Carboniferous, some 320 million years ago, probably were located at moderate northern latitudes. Early Permian faunas in Wrangellia are like those that today are in the

Canadian Arctic and Siberia.



Yukon-Tanana and Stikine terranes.

is now the eastern margin of

North America.

has not been definitely recognized as taking place

today, so that the present cannot be used as the key

to the past! One suggestion is that conversion from an

intraplate continent-ocean boundary to an interplate.

convergent margin takes place when an oceanic plate

grows and matures to the extent that its oldest part is

dense enough to subduct. The oldest part is where the

initial rifting started and where the adjoining continental

crust is thin, laced by old faults related to the original

is applied to such a boundary, it ruptures, and the old,

heavy ocean floor starts to sink into the mantle.

Evidence for compression of about the right age is

provided locally by Middle Devonian folding found in

the easternmost Columbia Mountains. The conversion

overlaps the time of the Acadian Orogeny along what

MIDDLE DEVONIAN ~390 Ma

rifting, and relatively weak. When lateral compression

An early Paleozoic continental margin is preserved in the eastern Cordillera. A thin sequence of mainly limestone and million years ago, records the major change along the dolomite (= carbonate), can be traced westward from the margin that eventually became the western margin continental interior into the easternmost Rocky Mountains and of North America, when the early Paleozoic *intra*plate then into a very thick carbonate succession deposited o continent-ocean boundary converted to the *interplate*, attenuated old continental crust stretched and thinned during convergent plate margin which has persisted, to a continental rifting and drifting. West of this, today in the western greater or lesser extent, until today. Remnants of a Rockies and Columbia, Omineca and Cassiar mountains continental margin arc, founded on oceanward parts of the old continental margin and possibly on old ocean continent. Basalt was erupted locally, and in places, sandstone floor, can be found in the Columbia Mountains and conglomerate and carbonate reflect high-standing parts of the outer margin. Still farther west, remnants of pre-Late Devoniar Just why this conversion occurred is not known - one

ocean floor are possibly present in southern Quesnel terrane. The tectonic setting in which these rocks were laid down comparable to that of today along the boundary between the North American continent and the western North Atlantic basin particularly the broad continental shelf off eastern Canada. One big difference is that mostly sand and mud are being laid dowr there today, although carbonate deposition is important in the southeasternmost United States and Bahamas. In the western Cordillera, the Alexander terrane in southeastern

Early Paleozoic

Alaska, the Saint Elias Mountains and, metamorphosed, in the Coast Mountains, comprises latest Proterozoic through Siluriar arc-related volcanic and plutonic rocks and accompanying sedimentary rocks, and also includes carbonate and shale deposited on some continental margin.

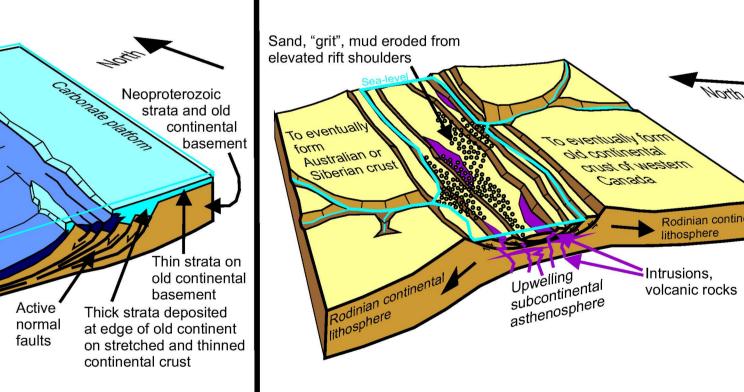
Just where did the Alexander terrane come from? Parts of the succession are not unlike rocks of the same age in the Caledonides of Norway and Scotland - or eastern Australia! Paleomagnetism in Early Devonian rocks indicates that the paleolatitude of the Alexander terrane at that time was similar to those of either Australia or the Barents Sea region, north of Norway Bilurian and Early Devonian fossils as well as detrital zircons favou a northern hemisphere origin, near Siberia or the Baltic Shield.

inherited from old continental crust and so they probably formed away from any continent.

The geographic relationships of terranes to the pre-Cordilleran continental margin and to must be used for older reconstructions. These include identifying "homelands" of different them to other terranes and/or other continents. From such studies we surmise that the inner (pink) terranes originated somewhere near the old continental margin, but mostly south of their present locations along it, whereas the outer (green) terranes originated far rom the old margin, and probably to the north of their present positions.

o the old continental margin starting about 185 million years ago, and the outer terranes vere terminally accreted about 100 million years ago, two dates that straddle the time of nost major Cordilleran mountain building. Terrane accretion has built the continental margin westward by some 700 km, concurrently with a roughly similar amount of

Neoproterozoic and(?) Early Cambriar



Most of the Canadian part of the North American continent, together with Greenland, was assembled by 1.8 billion years ago, from several small, Archean (>2. billion years old) continents brought together by Paleoproterozoic plate convergence.

By 1 billion years ago, all continents on Earth were together in a single supercontinent called Rodinia, whose precise geographic configuration is debated. One older configuration, shown on the inset map below, locates Australia near what became western Canada. positions Siberia next to western Canada.

About 750 million years ago Rodinia started to break-up. Elongate rift basins formed bounded by normal faults. The basins were filled mainly with mud, sand and gravel eroded from flanking elevated regions - rift shoulders arched up at the start of rifting. Carbonate, volcanics and glaciogenic sediments were deposited at times. Location of the basins, which cut across features in the crust of the

old continent, established the site of the future Cordillera. Precisely when Australia - or Siberia - drifted away from western Canada to open the remote ancestor of the Pacific Ocean basin is vet another matter for debate. However, by the late Early Cambrian, some 520 million years ago, the pre-Cordilleran intraplate continent-ocean

margin had formed near, and with similar orientation to, the Neoproterozoic rift basins.



DOSSIER PUBLIC through the GSC forma GEOLOGICAL SURVEY OF CANADA COMMISSION GÉOLOGIQUE DU CANADA

Recommended citation:

©Her Majesty the Queen in Right of Canada 200