= Anahim hotspot =

The Anahim hotspot is a volcanic hotspot in central British Columbia , Canada . It is situated on the Interior Plateau , a large region that lies between the Cariboo and Monashee Mountains to the east , and the Hazelton Mountains , Coast Mountains to the west . As a geologic hotspot , it is a place that has experienced active volcanism over a long period of time .

Identifiable from the mid @-@ Miocene period , it has recorded changes in the western @-@ moving North American Plate because it is believed to have been relatively stationary for tens of millions of years . Since then it has formed a line of volcanoes called the Anahim Volcanic Belt , stretching from the coast to the Interior Plateau near Quesnel . Each of the volcanoes was once over the hotspot , but migration of the North American Plate has pulled the volcanoes away from the hotspot 's magmatic source at a rate of 2 cm (0 @.@ 8 in) to 3 @.@ 3 cm (1 @.@ 3 in) per year . As a result , the volcanoes are progressively older to the west . The composition of magma to the volcanoes and its supply change with time as the volcanoes grow over the hotspot and migrate away .

= = Geological history = =

= = = Dike swarm emplacements = = =

The Anahim hotspot has a long history . About 13 and 12 million years ago , the Anahim hotspot created a peralkaline volcanic complex on what was then the coast of British Columbia , now heavily eroded to form the ~ 20 km (12 mi) long Bella Bella and ~ 6 km (4 mi) long Gale Passage dike swarms . Individual dikes are as thick as 20 m (66 ft) and have basalt , trachyte , and comendite compositions . The converging dikes may mark the first appearance of the Anahim hotspot . During the early to middle Miocene era , the passage of the Anahim hotspot beneath the range created the central Coast Mountains ; this orogeny caused reactions with the North American Plate in late Miocene @-@ Pliocene time .

= = = Rainbow Range eruptive period = = =

During a period of 2 million years , extrusion of highly fluid basic and silicic lava flows built up the gently sloping Late Miocene Rainbow Range . It is one of three large peralkaline shield volcanoes that lie on an east @-@ west trend in west @-@ central British Columbia . Alkaline and peralkaline lava flows from four volcanic episodes make up an 845 m (2 @,@ 772 ft) composite section on the north flank of the shield volcano . Basal comenditic trachyte flows are unconformably overlain by flows and flow breccias of mugearite . A sequence of 40 ? 60 m (130 ? 200 ft) thick columnar @-@ jointed comendite flows blankets the underlying units and gives the volcano its shield @-@ like form . Hawaiite dikes , plugs , and minor capping flows are scattered over the north flank . Comendite flows , which commonly have a glassy selvage at the base , account for 75 % of the lavas in the flank zone . The Rainbow shield was erupting until 6 @.@ 7 million years ago .

= = = Ilgachuz Range eruptive period = = =

Over a period of 2 million years , extrusion of highly fluid basic and silicic lava flows built up the gently sloping Late Miocene @-@ to @-@ Early Pliocene Ilgachuz Range . It is the second youngest of the three large peralkine shield volcanoes that lie on an east @-@ west trend in west @-@ central British Columbia with a diameter of 25 km (16 mi) . The Ilgachuz shield was created by two chemically separate magmatic periods ; an early complex series of trachyte and rhyolite eruptions and late extrusion of a sequence of basaltic lava flows . The surface of the outer shield , cut by deeply incised radial valleys , rises to a complexly dissected summit area where remnants of a small central caldera and numerous felsic domes and basaltic feeders are exposed . The outer

flanks of the shield merge with flat @-@ lying basalt of the Chilcotin Group , which is thought to have been formed by a back @-@ arc basin behind the Cascadia subduction zone . The volcano was spewing out ash , cinder , pumice , rhyolite , trachyte and basaltic lava up until 4 million years ago .

= = = Itcha Range eruptive period = = =

During a period of 3 million years , extrusion of undersaturated trachyte flows built up the gently sloping Late Pliocene @-@ to @-@ Pleistocene Itcha Range . It is the easternmost and youngest of the three large felsic shield volcanoes lying on an east @-@ west trend in west @-@ central British Columbia . It has a diameter of 15 km (9 mi) . The broad scale morphology of the Itcha shield is given by the extensive lateral distribution of thick (70 ? 150 m (230 ? 490 ft)) felsic flows which erupted from fissure vents around a central vent to cover an area of 330 km3 (79 cu mi) . Most late @-@ stage lavas capping the Itcha shield complex were erupted from cinder cones , tuff rings , and fissure vents in the eastern half of the complex about 80 @,@ 000 years ago .

= = = Nazko Cone eruptive period = = =

Throughout the Holocene epoch , the Anahim hotspot has energized numerous volcanoes . This volcanic activity has produced numerous Hawaiian eruptions , which created lava fountains , small cinder cones and lava flows . The youngest expression of the Anahim hotspot is Nazko Cone , which formed about 340 @,@ 000 years ago . The most recent eruptive activity at Nazko Cone occurred about 7 @,@ 200 years ago . This is very recent in geological terms , suggesting that the volcano may yet have some ongoing volcanic activity . The Rainbow Range is the largest Anahim volcano , although Nazko Cone is now the site of the most intense volcanic activity , located directly on top of the Anahim hotspot at . Its last eruption started with an eruption of two different progressions of runny lava flows , which resulted in an older , grey basalt becoming overlain by a younger , darker black basaltic lava flow . The passive eruptions were followed by a period of explosive eruptions . This explosive activity built three overlying cinder cones that broke by the two lava flows near the end of the explosive phase of activity . The last phase of explosive activity spread tephra to the north and east of the cones . The deepest deposits near the cone are less than 3 m (10 ft) ; that they thin to less than a few centimetres only a few kilometres away , suggests that the explosive eruptions at Nazko Cone were fairly small . However , the last eruption from Nazko Cone could have started forest fires , since there is charcoal inside the tephra layer .

= = Petrology and geochemistry = =

Analysis of the chemical composition of the lavas gives important clues about the source and dynamics of the hotspot plume . Where hotspots occur under thick continental crust , basaltic magma is trapped in the less dense continental crust , which is heated and melts to form rhyolites . These rhyolites can be quite hot and form violent eruptions , despite their low water content . Such rhyolitic magma can be found at the western part of the Anahim Volcanic Belt , which contrasts the more basaltic material in the Nazko Cone area . This suggests that as the North American Plate moves westwards , the Anahim hotspot underlies thinner continental crust . This hypothesis has been verified by observation of the crustal regime in other compression margins ? the thickest granitic structures are found near the margin itself , with the North American Plate becoming less compressed in regions away from the margin . In this case , the thinner crust would represent briefer travel time , thus reducing the time available for magma differentiation , whose end products are rhyolites . As most magma is basaltic in origin , the eruption would therefore contain more basaltic materials . A few igneous rock types with composition unlike basalt , such as nephelinite , do occur at the small basaltic cinder cones and flows but are extremely rare .

Basaltic lava flows have a high ferromagnesian (iron and magnesium) content and erupt at temperatures between 1000 ° C and 1200 ° C ; these values are higher than those of other common

igneous rocks . Due to the high temperature of this lava flow , the lava would be extremely fluid (it has low viscosity) , allowing the lava to travel long distances from the magma source (the volcano or vent) . These extremely fluid lavas have flow speeds that depend heavily on underlying terrain , with a maximum of almost 60 kilometres per hour (37 mph) in underground lava channels . Flow independent of such channels and tubes moves quite a bit slower , averaging speeds of 1 @.@ 6 km (1 mi) per hour . However , this flow speed changes considerably within the flow , with speeds depending heavily on depth and degree of cooling that the flow has experienced (essentially distance from the vent) . Although the Nazko area flows would not be highly basaltic like those found in Iceland or Hawaii , lower depths are unlikely as viscosity is normally higher .

A few volcanic centers in the vicinity of the Bella Bella and Gale Passage dike swarms , such as Helmet Peak and Kitasu Hill , which are members of the Milbanke Sound Group , may represent the westernmost of the Anahim volcanoes , but their ages are significantly different , provoking on @-@ going questions about their origin and connection to other regional volcanic activity . However , many volcanoes in that center are believed to be monogenetic , suggesting a monogenetic volcanic field may be responsible .

= = Origin = =

The source of the Anahim hotspot is a matter of controversy . Some geologists hypothesize that the Anahim hotspot is linked with an upper mantle plume (miniplume) rather than the more common deep mantle plume because of the small size of the Bella Bella and Gale Passage dike swarms . Others prefer to attribute the hotspot to tensional cracking of the lithosphere above the northern edge of the subducting Juan de Fuca and Explorer plates at the Cascadia subduction zone or interpreted as an edge effect of the subducting plates in the mantle . None of the hypotheses so far suggested is without critics . Part of the controversy is due to the rather sudden appearance of the hotspot in the geologic record . A number of hotspot models have been suggested to explain tensional cracking origins , however . Some of Earth 's more prominent hotspots were unified along with flood basalt volcanism and continential rifting . While mafic lava flows appear to merge laterally with the less silicon @-@ undersaturated lavas of the Chilcotin Group surrounding the Anahim Volcanic Belt , the particular nature and connection between the Anahim hotspot and the Chilcotin Group is unknown . Volcanic chemistry and isotopic composition of the Anahim Volcanic Belt do not distinguish between either a rift or a hotspot setting .

= = Future and present = =

Volcanism appears to have ceased in the western parts of the Anahim Volcanic Belt , but if that is correct , future eruptive activity can be expected in the Nazko Cone area and east of it . Future eruptions from the Anahim hotspot are most likely in the creation of basaltic cinder cones , but eruptions of less mafic magma , typical of the eastern portions of the Anahim Volcanic Belt , cannot be ruled out .

= = = Seismology = = =

The Anahim hotspot is the only notable earthquake zone in the Canadian Cordillera away from the British Columbia Coast . A series of < 3 @.@ 0 magnitude earthquakes began October 9 , 2007 with its epicenter in the McNaughton Lake region near Nazko Cone , which could signal the resumption of intense subterranean volcanic activity in the area . Thirty @-@ four such < 3 @.@ 0 magnitude earthquakes were observed on October 10 , 2007 alone . Since then more than 1 @,@ 000 small earthquakes have been recorded . They are thought to have originated 25 km (16 mi) below the surface , but none of them have been felt by people . The cause of this seismic activity is believed to be the upwelling of 500 @,@ 000 m3 (650 @,@ 000 cu yd) of magma , because the area is not close to any faults or tectonic plate boundaries . This is the first indication of potential volcanic activity in Canada since around 1830 to 1850 in northwestern British Columbia .

The recent earthquake swarms in the Anahim hotspot have aroused much interest from volcanologists and seismologists since they began on October 9 , 2007 . More than 1 @,@ 000 earthquakes have now been detected , and seven stations are now monitoring the area for further activity . The region 's earthquake swarms have given rise to speculation of a possible eruption , a possibility estimated around 10 % . An eruption in the region would not cause many fatalities , due to the region 's remoteness , but people engaged in logging and ranching in the region are at risk . The greatest threats would be from forest fires and possible health risks to those in the area if volcanic gasses or ash columns were released . Also , the Anahim hotspot is situated in the immediate proximity of a major air traffic route , and volcanic ash reduces visibility and can cause jet engine failure as well as damage to other aircraft systems .