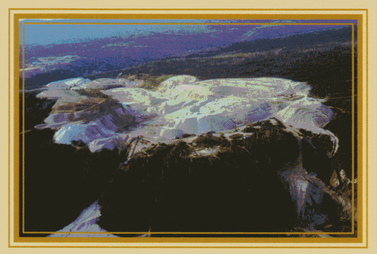
White Channel Gravel

Klondike Gold Fields, Yukon, Canada



Photograph 1. Aerial view of mining the White Channel Gravel.

The Early Years

The White Channel Gravel is the most important placer gold deposit in the Klondike area. Found locally on hills, it was referred to as the 'white channel gravels', the 'white wash', or simply the 'quartz drift' by early Klondike gold fields in 1898. Arriving soon after the discovery of gold, his reports and maps still provide valuable information and insight into the nature of the White Channel Gravel. Despite continuous mining for nearly 100 years, the White Channel Gravel is the subject of on-going research.

On The Hilltops

The White Channel Gravel is classified as one of the 'high level gravels' in the Klondike. It occurs principally as a discontinuous, wide bench, or terrace, 50 to 100 metres above the present day Bonanza, Eldorado and Hunker Creeks (see map). Significant deposits occur also on Allgold, Quartz and lower Dominion Creeks, with perhaps minor occurrences along the Indian River and at a few other localities (i.e., Bear, Sulphur and Gold Run Creeks). The deposit generally increases in thickness away from King Solomon Dome, reaching a maximum preserved thickness of approximately 40 metres. It may have extended into the present day Klondike River valley and westward, towards Dawson.

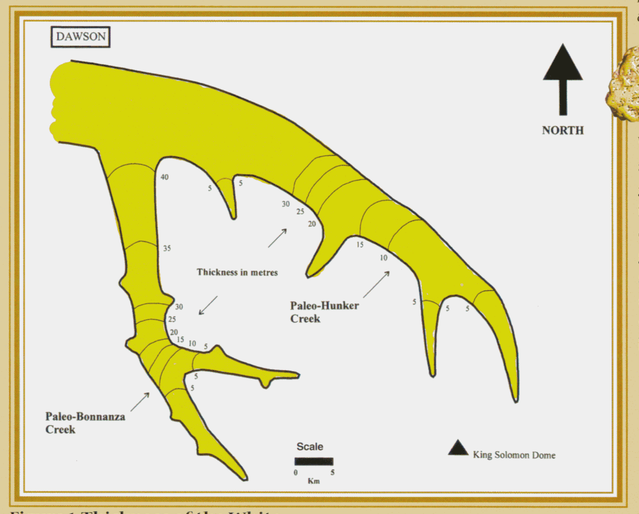


Figure 1. Thickness of the White Channel Gravel.

Gravel With Sand

As its name implies, the White Channel Gravel consists of a succession of predominantly gravel, with lesser amounts of interbedded sand. Although it is characteristically a uniform, light gray to nearly white colour, darker shades of gray, yellow and red occur locally. The gravel contains sub-angular to rounded, pebble- to boulder-sized clasts (up to 2 metres in size) of vein quartz (~70%), schist (~20%) and rhyolite (~10%). The abundant quartz clasts in the gravel indicate that it formed during long periods of weathering, alternating with very brief but intense periods of mechanical abrasion. In between the clasts is a compact matrix of sand- to mud-sized grains of quartz and muscovite. The gravel and sand beds often display various types of sedimentary structures (such as cross-bedding) that indicate deposition in a fluvial environment. The White Channel Gravel lies on deeply eroded, metamorphosed Paleozoic bedrock, and is overlain by, and interbedded with, a second gravel deposit referred to as the Klondike Gravel.

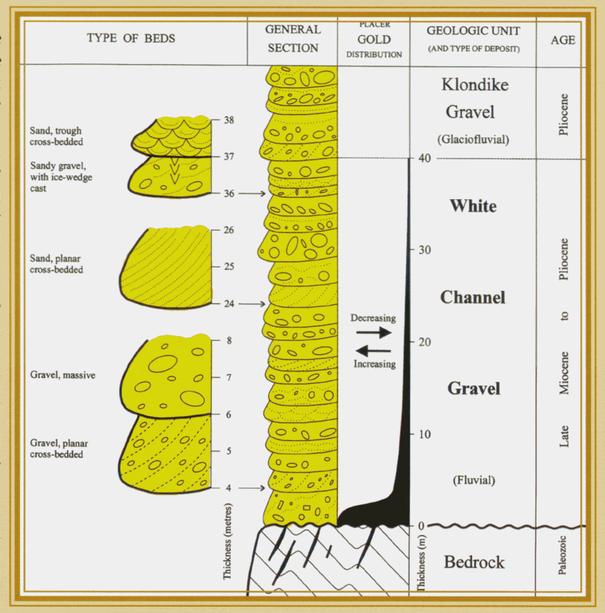
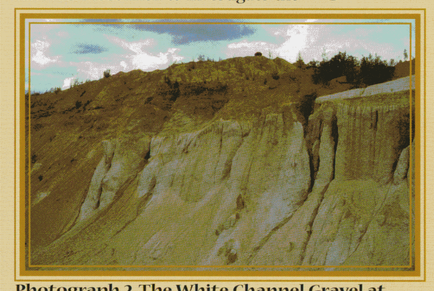


Figure 2. General characteristics of the White Channel Gravel.



Photograph 2. The White Channel Gravel at Dago Hill.

Photograph 3. Vein quartz pebbles in the White Channel Gravel.

Before Beringia

The White Channel Gravel formed millions of years before the Last Ice Age that created the ice-locked subcontinent called Beringia. During the Miocene Epoch (more than about 5 million years ago), the Klondike area was much warmer and received more precipitation than at present. This resulted in an extensive, debris covered peneplain with low rounded hills, and the White Channel Gravel began to accumulate in stream valleys that radiate outwards from what is now King Solomon Dome. Between 5 and 3 million years ago, northward flowing paleo-Bonanza and 'paleo-Hunker' Creeks probably existed as perennially braided rivers. These rivers may have had pronounced short spring floods and longer periods of slowly tapering summer discharges, somewhat analogous to modern glacial outwash plains. Calculations based on the maximum grain size and the percentage of mud preserved in the White Channel Gravel, reveal that mean annual discharges may have been about 8 cubic metres per second (or about equal to the flow of the Kathleen River at Kluane National Park on the Haines Road), whereas mean annual floods may have been as great as 241 cubic metres per second (or about equal to the flow of the Yukon River at Whitehorse). During floods, the river channels may have been up to 74 metres wide and 2 metres deep, and they continuously reworked gravel across valleys 2 to 4 kilometres wide, carved into bedrock. The valleys and surrounding hills were probably covered in a dense boreal forest, much like today, but with more pine trees present. About 3 million years ago, the climate of the Klondike area changed dramatically due to the onset of the pre-Reid glaciation. Ice-wedge casts preserved in the upper part of the White Channel Gravel document periglacial (cold climate) conditions, during which time the forest cover was replaced by grassland. As the glaciers expanded beyond the Ogilvie Mountains (to the northeast), rivers draining from the ice brought with them the Klondike Gravel. Deposition of glacial outwash (ie., Klondike Gravel) on top of White Channel Gravel led to the demise of the White Channel Gravel.

Photograph 4. Gravel and sand beds in the White Channel Gravel.

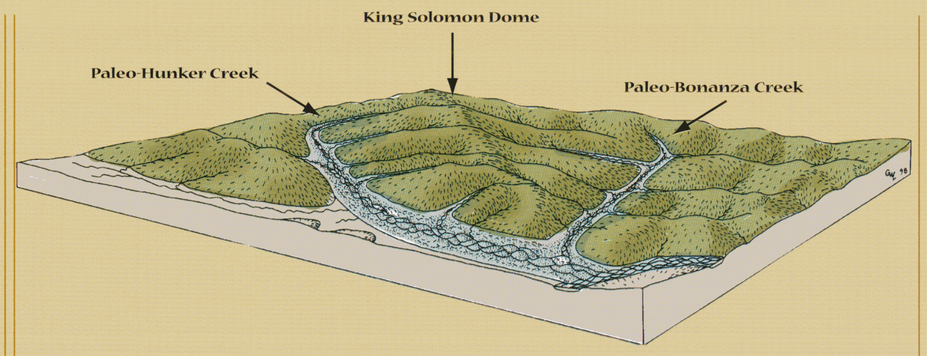


Figure 3. View looking south showing deposition of the White Channel Gravel in paleo-Bonanza and paleo-Hunker Creeks, approximately 4 million years ago.

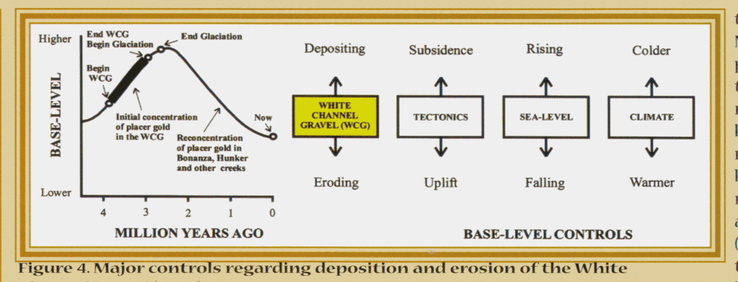


Figure 4. Major controls regarding deposition and erosion of the White Channel Gravel (WCG).

Deposition Versus Erosion

Several fundamental controls governing sedimentation in a fluvial environment (and determining whether the White Channel Gravel was being deposited or eroded) include tectonics, sea-level and climate. These three factors influence the base-level of a river (i.e., the level below which erosion cannot occur). Little is known about the tectonic evolution of the Klondike area during the last 5 million years, and although sea-level was apparently rising during deposition of the White Channel Gravel (as evidenced by the Beringia transgression along the coast of Alaska), the Klondike area was too far inland to have been affected by any fluctuation in sea-level. Climate then, was probably the main factor influencing the White Channel Gravel. It is known that the climate was getting colder during deposition of the White Channel Gravel because of the expanding pre-Reid glaciers. The glaciation not only lowered temperatures, but it also brought about a decrease in vegetative cover in the valleys. This caused an increase in sediment delivery to the rivers which resulted in a higher base level for the paleo-Bonanza and paleo-Hunker Creeks, favouring deposition of the White Channel Gravel. As the pre-Reid glaciation ended, the transition from colder to warmer temperatures brought an increase in precipitation and runoff. However, sediment delivery remained low because vegetation quickly stabilized the river valleys. This resulted in a lowering of base level which favoured erosion of the White Channel Gravel. New streams, similar to the present Bonanza and Hunker Creeks, meandered back and forth in the valleys, and carried away more than half of the White Channel Gravel, but apparently left behind most of the gold.

All That Glitters

The Klondike gold fields are considered a giant gold field because of the amount of placer gold produced: about 311 metric tons, or a solid gold block roughly the size of two cords of wood (one cord of wood measures 4x4x8 feet, or 1.2x1.2x2.4 metres). Gold in the White Channel Gravel is concentrated on bedrock and within the first 1 to 2 metres of the gravel, decreasing rapidly up-section (Figure 2), with a pay streak that is approximately 100 metres wide. Fist-sized nuggets to minute flakes capable of floating on water have been recovered, and the gold has a fineness (or purity, with 1000 representing pure gold) ranging from about 700 to 850. The origin of coarse gold in any placer deposit is controversial: some researchers believe that nuggets can only form by chemical precipitation in sediment, whereas others insist that nuggets are entirely mechanical in origin. McConnell thought that practically all of the placer gold in the White Channel Gravel was detrital, and that it had been locally derived from auriferous quartz veins (a view held by most geologists today, and supported by the fact that nearly 40 kilograms of gold have been produced from quartz veins on the Lone Star property, the best-known lode gold mine in the Klondike). McConnell also noted that the distribution of the White Channel Gravel is marked by a trail of gold, even when the gravel has been eroded. The gold in Bonanza and Hunker Creeks was derived from erosion of the White Channel Gravel. The erosion of the gravel, and subsequent reconcentration of gold in the creeks, was due to the lowering of base level at the end of the pre-Reid glaciation. Note then, that as the placer gold gravitated to a lower elevation, in response to a drop in base-level, it became more concentrated because of the reduction in accomodation space (i.e., the gravel became thinner). Mass balance calculations indicate that anywhere from 200 to 2,000 cubic kilometres of rock were eroded to produce the amount of gold recovered from the Klondike gold fields. A seemingly insignificant trace amount of gold in this quantity of bedrock would be sufficient to account for all the gold recovered, implying that there is no 'mother lode'. Could there be other areas where the White Channel Gravel has not yet been found? Perhaps, and with it, a fortune in gold on the hilltops waiting to be claimed!

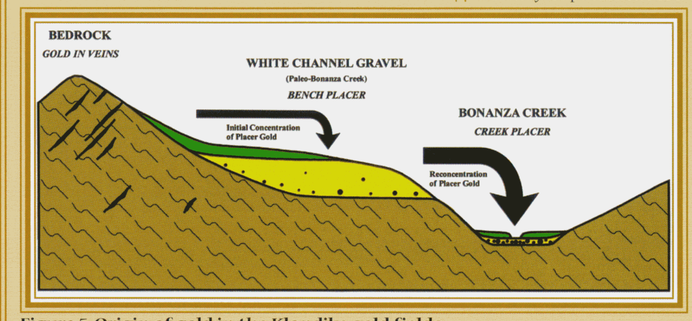


Figure 5. Origin of gold in the Klondike gold fields.

Additional Reading

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