

Discovery and Significance of the Middle Cambrian Burgess Shale

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Was the discovery of the Burgess Shale a fluke of history and purely serendipitous? Historians would debate this point. Nonetheless, a late decision of the Canadian Pacific Railway to cross the main Ranges of the Canadian Rockies through the Kicking Horse Pass instead of following an easier northern route as first planned, and the burgeoning tourism industry in western Canada, certainly played key roles. A consequence of these developments was the discovery, around 1886, of the Mount Stephen “fossil beds” (now known as the Trilobite Beds), by carpenters working in the village of Field along the newly opened railroad. These fossils provided the impetus for the 1909 discovery, a few kilometres to the north, of what would later become known as the famous Burgess Shale site. It is this second discovery, made by Charles Walcott on Fossil Ridge that remains the most remarkable. Never before had someone stumbled upon such complete and exquisitely preserved soft-bodied animals from the Cambrian Period. Walcott immediately realized the importance of these fossils and, as soon as the initial news of the discovery emerged, the Burgess Shale became an instant sensation, quickly transcending conventional scientific circles. The first popular article on the Burgess Shale written by Walcott himself appeared in the *National Geographic Magazine* a mere two years after his discovery.

One hundred years after Walcott's discovery, the Burgess Shale continues to excite scientists and the public alike. One of the main reasons for this continuing interest is the apparent bizarreness of many of these marine creatures, which predate dinosaurs by hundreds of millions of years. Indeed, their very names often reflect this sense of strangeness, including such examples as *Hallucigenia* - a worm-like animal with pairs of spines on its body - and *Anomalocaris*, literally meaning “curious shrimp.” Many of these creatures have become pop-culture icons and now belong to the arena of familiar prehistoric beasts like *Brontosaurus* or the woolly mammoth, and justifiably so. Despite their apparent differences from anything we know today, these 505 million year old remains are arguably some of the most important in the fossil record. They represent our best evidence for the origin and early evolution of modern animals during the Cambrian Explosion, following billions of years of primarily microbial evolution. The Burgess Shale is not the only such deposit, however. We now know that similar fossils are far more widely distributed, geographically and temporally, than previously thought, with sites in North America, China, Australia, Russia and Europe, ranging in age from Lower to Middle Cambrian. The widespread occurrence of Burgess Shale-type fossils in normal shallow to relatively deep marine environments confirms the status of this biota as part of a global evolutionary fauna that emerged just after the Cambrian Explosion.

Today, research continues at the type localities around Field and with new field investigations in areas once thought to be devoid of Burgess Shale-type fossils. New

specimens and species continue to be added to the plethora of organisms already known. In the original Walcott Quarry site alone, up to 200,000 specimens representing close to 200 species have been collected so far, and there is no sign we have reached the full diversity of this biota yet. Discoveries of new species will continue in the foreseeable future, helping to refine our views on the ecology and evolution of some of the first complex animal communities on Earth.