Flood Basalts

Introduction

A flood basalt is the result of a giant volcanic eruption or series of eruptions that covers large stretches of land or the ocean floor with basalt lava. They are said to be the result of mantle convection through hot spots, which occur sporadically in time and place.

The New Penguin Dictionary of Geology (Kearey, 1996) has defined flood basalt as “an extrusion of low viscosity basaltic magma of very large volume”. Sigurdsson (1999) defines flood basalts as “laterally extensive deposits of basaltic lava flows, resulting from outpouring of vast volumes of magmas during fissure eruptions” whereas Bardintzeff and McBirney (2001) similarly define flood basalt as “a voluminous, laterally extensive lava flow, normally erupted from a fissure”

A more ancient term, traps (meaning “steps” a reference to the step-like geomorphology of eroded flow layers) is occasionally used for continental flood basalts, and is a part of the formal name applied to some occurrences such as the Deccan traps and Siberian Traps.

The flows are unusually fluid and rapidly erupted, hence covering extensive areas with large volumes of magma (Both cumulatively and as individual flows). Continental flood basalts are typically fissure fed, corresponding to extensional tectonics and continental rifting.

Major Occurrences

Some examples of major flood basalts are

Lake Superior- USA (Late pre-Cambrian 110-1200 my)

Parana- Brazil (Jurassic-cretaceous 120-150my)

Deccan traps- India (Cretaceous- Eocene 60-65my)

Columbia river basalt- USA (Miocene 6-17my)

The giant flood basalts accumulations grade downward in size to numerous smaller, rift related volcanic provinces. Erosion in these volcanic piles has revealed cogenetic mafic intrusions, including sills, dikes and the more mafic layered intrusions.

Tectonic settings of Continental Flood Basalts

An important aspect of Continental flood basalt volcanism is its correlation with the process of continental rifting. They are typically associated with the incipient stages of successful continental rifting. The Parana, karoo, North Atlantic and Antarctic provinces occurred at sites undergoing initial continental fragmentation that led to the opening of the Atlantic and Indian Oceans. These are now classic volcanic passive margins, and continental flood basalts are an early continental manifestation.

Mantle plumes and hotspots are commonly associated with continental breakup, and plumes are now generally recognized as the principal cause of Large igneous provinces, including continental flood basalts. In case of Deccan in India, the period of intense igneous activity postdated the rifting between India and Africa by about 50 Ma. Plate tectonic reconstructions for the period of

flood volcanism put Deccan area near or over the plume now beneath Reunion Island. In this case, hotspot activity alone was apparently sufficient to generate this huge flood basalt province.

Another possible setting for some continental flood basalts is back-arc spreading. Many investigators consider the Columbia River Basalt group to be a result of back-arc spreading behind the Cascades arc in a continental environment.

S-4: Composition

Most are tholeiitic in composition, although more or less evolved types also occur.

A variety of rock types including quartz tholeiites, olivine tholeiites, andesites, rhyolites, trachytes have been reported from various provinces.

Pyroclastic rocks indicating explosive nature of volcanism and deposits of shale's, limestone's etc. indicating quite periods are common in such provinces.

S-5: Structure

The lava flows are of simple or compound type.

Simple lava flows are massive in nature, with no vesicles and amygdales. They are thick and show columnar jointing.

Compound lava flows are made up of small units of lava and are full of amygdales.

S- 6: Columbia River Flood Basalt

The Columbia River Flood Basalt Province forms a plateau of 164,000 square kilometers between the Cascade Range and the Rocky Mountains. In all, more than 300 individual large (average volume 580 cubic km!) lava flows cover parts of the states of Idaho, Washington, and Oregon. At some locations, the lava is more than 3,500 m thick. The total volume of the volcanic province is 175,000 cubic km.

S-7: Deccan Traps

The Deccan Traps are one of the largest volcanic provinces in the world. It consists of a composite thickness of more than >2,000 m of flat-lying basalt lava flows and covers an area of nearly 500,000 square km in west-central India. Estimates of the original area covered by the lava flows are as high as 1.5 million square km. The volume of basalt is estimated to be 5,12,000 cubic km. The Deccan Traps are flood basalts similar to the Columbia River basalts of the northwestern United States.

The Deccan basalts may have played a role in the extinction of the dinosaurs. Most of the basalt was erupted between 65 and 60 million years ago. Gases released by the eruption may have changed the global climate and lead to the demise of the dinosaurs 65 million years ago.

Thank You.