The Breitenbush Hot Springs area lies on the boundary of folded middle to late Tertiary Western Cascade rocks and younger High Cascade rocks. Within the mapped area
overlain unconformably by the Breitenbush Tuff. The Breitenbush Tuff consists of three units of welded pumice-rich, crystal-vitrif catalyst flow tuffs interbedded with tuffaceous sedimentary rocks. The Outerson Formation unconformably overlies the Breitenbush Tuff and consists primarily of basaltic lava and breccia.

The Outerson Formation includes three localized members: a basal, glassy, aphanitic basalt, the Lake Leone Sediments, and the Outerson Tuff. The Outerson Formation is cut by a number of feeder dikes and plugs and is unconformably overlain by the Cheat Creek Sediments, composed of volcanic sedimentary rocks and a distinctive basaltic tuff. The Western Cascade formations total more than 1660 m (5500 ft) of strata and range from Oligocene to Pliocene in age.

The High Cascade rocks are represented by two formations: the Triangulation Peak Volcanics of basalt and andesite lava and breccia, lying unconformably atop the Cheat Creek Sediments; and unconformably beneath the Collowash Volcanics, a series of thin basaltic lava flows and breccias. The Western and High Cascade rocks are covered extensively by surficial deposits, primarily glacial drift. The High Cascade formations are at least
faulted in the Breitenbush Hot Springs area, and form the eastern limb of the north-trending Breitenbush Anticline. The folded rocks and the erosional unconformities between the rock units probably represent two local episodes of orogeny: one in early to middle Miocene and another in late Pliocene to Pleistocene time. The Outerson Formation represents a depositional sequence between the periods of uplift and deformation. Faulting accompanied the orogenic sequences.

The primary volcanic landforms in the area have been destroyed by erosion but skeletal remains of High Cascade volcanoes are recognized. Stream erosion and glaciation are responsible for the present landforms.

Breitenbush Hot Springs occurs, in part, along basaltic dikes which channel the water through impermeable Breitenbush Tuff. The dikes are believed to be associated with the Outerson basalts. The Hot Springs discharge upwards at 3400 l/min. (900 gpm) of water at temperatures up to 92°C (198°F).