Tuff Encyclopedia Article

Tuff

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Tuff

Tuffs are volcanic **igneous rocks** composed mostly of compacted volcanic ash and **sand** (particles less than 0.16 in [4 mm] in diameter). Tuffs often show well-defined layers, recording episodic falls of ash, and may be classified in various ways. First, they are often named according to the types of recognizable **rock** fragments embedded in them (i.e., **basalt** tuff, **andesite** tuff, **rhyolite** tuff, etc.). They may also be classified as vitric, lithic, or crystal; vitric tuffs consist mostly of glassy particles, lithic tuffs of rocky particles, and crystal tuffs of visible **crystals**. Tuff may also be characterized as lapilli tuff or tuff-breccia: lapilli tuff consists of ash mixed with lapilli (volcanic fragments 0.08–2.5 in [2–64 mm] in diameter); tuff-breccia consists of ash mixed with block-sized (volcanic fragments >2.5 in [64 mm] diameter) fragments.

Volcanoes lay down tuffs by various processes. First, ash lofted to high altitudes may spread over thousands of square miles of terrain before settling out to produce a relatively thin layer of tuff. Such layers are useful to geologists as marking a specific moment in geological time over a wide region. Second, ash lying on the sides of a **volcano** may become saturated by the torrential rains that often occur in response to **volcanic eruptions** and pour down the cinder cone as a **mud flow**. Third, ash may erupt straight up and spread around the vent as a backfill flow. Fourth, large masses of ash and sand mixed with hot gas can be ejected by a volcano and **avalanche** rapidly down its slopes. Such an avalanche is called a *nuée ardente* (pronounced nie-ay-ar-DAHNT; French for burning cloud). A *nuée ardente* can be carried by its momentum many miles from its source, even traversing mountain ridges to lay down ash in distant valleys. After settling, the heat and weight of the ash deposits left by a *nuée ardente* often weld their particles together, creating the rocks termed welded tuffs.

Tuffs are usually much altered in composition and texture after deposition. Alteration may begin with the stewing of a hot ash layer in its own gasses and condensed fluids, or with the addition of outside **water** to the hot ash. Over geological time, few tuffs escape alteration, especially by devitrification. In devitrification, the chaotically mixed atoms in a tuff's volcanic **glass** (which is inherently unstable in atmospheric conditions) reorganize themselves into crystals.