The potash potential of Ethiopia was dormant until World War II where Italian and other foreign companies initiated exploration activities in different parts of the extremely hot Danakil Depression of northern Ethiopia, where temperatures regularly exceed +50°C. The companies exploited a number of mineral resources, such as potash and sulphur. The Danakil depression is found down to 110 m below sea level. The evaporites of the central parts of the Danakil Depression cover an area of 1165 km², the major part of which is known as the Salt Plain.

The Afar region of north-east Ethiopia is covered by Quaternary lacustrine sediments and volcanic rocks of the East African Rift Valley. The central part of the Danakil Depression is covered by a thick evaporite succession (Salt Formation), which is partially covered by Quaternary volcanic rocks.

The Salt Formation is composed of a thick evaporite succession of gypsum, anhydrite, mixed with layers of halite and potash salts, as well as shales. Mount Dallol is a type area for the Salt Formation. It is a regular salt mountain, situated in the middle of the Salt Plain. This formation was uplifted by volcanic action, and has numerous craters and hot springs.

Geology of potash deposits

The potash deposits occur within the evaporite sequence, which is essentially confined to the areas, below the present sea level, of the Danakil Depression. The salt formations on the surface cover an area of about 1165 km², but only a small part of this area has been explored. Gypsum is the most widespread lithology on the surface, but halite and potash salts are also found both as isolated outcrops on the surface and at depth. The gypsum beds form the outermost units of the evaporite sequence and thickness of the sequence is unknown; however, the deepest hole drilled remained in salt to a depth of about 1000 m. Several potash horizons are recognised, although only the uppermost have been explored.
On Mount Dallol a sequence of evenly bedded layers of salt 20–30 cm thick, interbedded with thin clay and gypsum layers is exposed. The salt is stained in red, brown and yellow colours due to the oxidation of iron and sulfur emanating from fumarolic vents. A cap rock of gypsum and clay overlies the salt sequence and is believed to represent the last stage of evaporite deposition in the basin. Sylvite, carnallite and sulphur outcrops occur around the central crater of the mountain.

Potash Resources

Exploration work carried out by various companies until now has revealed the presence of two ore bodies at the Danakil Depression. These are the Crescent and Musley ore bodies.

Crescent Ore Body

The ore body is irregular in shape, relatively flat lying and about 1000 m long and 100 m wide. The deposit surrounds a bubbling spring of magnesium chloride-rich water; located on the surface and occurring down to c. 90 m, mainly in the form of carnallite and some sylvite. The maximum thickness is up to c. 60 m. The ore reserves in the Crescent ore body have been estimated to be 10–12 million tonnes with a cut-off value of 25% sylvite. From this reserve it is expected to be possible to recover around 3 million tonnes from a 1.5 m thick layer.

Musley Ore Body

This ore body extends over a length of about 4 km and a width of about 1.5 km striking about 25°N. The largest potash deposit, Musley, was extensively explored during the 1960s.

Within the thick sequence of halite, there is a potash-rich interval consisting of sylvite (upper-most), carnallite and basal kainite. This interval was explored by drilling with 300 m spacings, by shaft-sinking (90 meters) and by underground work down to 800 m to evaluate mineability.

Drilling indicated the presence of a 500 m deep potash-bearing horizon similar to that explored by the underground work and by shallow drilling. The potash beds are shallowest in the western part of the basin and dip to the east. At Musley, drill-hole information suggests that the potash-rich horizon underlies an area at least 19 km long (north-south) and nearly 11 km wide. However, the full extent of this horizon is not yet determined.

Drilling and underground work resulted in an ore reserve estimate for Musley of 66 million tonnes ‘proven’ and 32 million tonnes ‘probable’. Both reserves are averaging 33% sylvite, with a cut-off grade of 25% sylvite and a 2.1 m minimum mining thickness. Reserves in the category ‘possible’ were estimated to around 62 million tonnes, resulting in a total of 160 million tonnes of reserves.

Companies operating in the Danakil Depression

The following companies are operating in the Danakil Depression exploring for potash and related salt minerals: Sainik Coal Mining plc, Ethio-Gibe Canada Mining plc, G and B Central African Resources Ltd, BHP Billiton World Exploration inc, SB Management inc, Forbs & Manhattan inc, Nova Potash plc and Haro Petroleum Corporation. Sainik Coal Mining plc also has an active mining license.

Drilling for potash in the Danakil Depression.