Rock layers in the Naukluft formed in Ancient Seas

Sedimentary rocks preserve ancient environments. Most of the Naukluft Mountains rocks date from the Neoproterozoic Era, before large animals and plants evolved on Earth, so there are only a few fossils.

Limestone and ***dolomite*** formed in warm, shallow sea water. Thin lacey layers show rounded mats of algae from the ancient sea floor. The chemistry of these rocks reveals the composition of the oceans where early life thrived.

Sandstones formed on beaches and tidal areas washed by waves, from the accumulation of tiny mineral grains brought by rivers and wind to the sea. Amongst the grains are crystals of the mineral zircon which record the age of the mountains that eroded to produce the sand.

Shale forms easily-split, soft, thin layers of green, red, and purple. These rocks formed in deeper, quieter sea water. The younger shales in the Naukluft sometimes contain shells and burrows from early sea creatures.

Layered rocks were bent and stacked by tectonic forces

About 550 Million Years ago, two ancient continents, the Kalahari and the Congo, collided. Their collision compressed and buckled the sedimentary layers and eventually closed the sea where most of the Naukluft Mountains rocks were deposited. The layers were shoved together, older over younger, as if shuffling the pages of a history book. The effects can be seen everywhere in the Naukluft Mountains as bent, broken and tilted layers of rock.

The rock layers lie flat on the plains south, east, and west of the Naukluft . The folded rocks were shoved southward over the flat rocks along a major ***thrust fault*** - the Naukluft Thrust. This fault can be seen in the Naukluft River gorge and all around the mountains as a thin, planar orange stripe. This fault caused ancient earthquakes during the tectonic collision.

Thin layers of limestone and shale are tightly folded. White mineral **veins** of calcite cut through the folds. **Folds** like this throughout the mountains indicate that the rocks were pushed toward the southeast when the continents collided.

Strong layers become mountains, soft rocks make valleys

Over thousands of years, rain and wind carve valleys through soft rocks, leaving hard rocks standing high as hilltops and cliffs. The shape of the modern Naukluft Mountains closely follows the forms of the bent and stacked rock layers. Resistant cliffs of orange to tan dolomite top many of the ridges. Kloofs (narrow slot canyons) form where water carves down through a crack in the hard dolomites. Smooth slopes of shale show where erosion has easily removed sediment.

Seasonal rains and underground rivers

In the Naukluft Mountains, heavy rains only come in the autumn. Connected fractures in the rock allow rain to penetrate deeply and feed springs which sustain wildlife and farms the rest of the year. Much of the water that feeds boreholes and wells fell thousands of years ago when the climate was much wetter. This ancient water follows buried riverbeds to the west under the plains and also supplies Luderitz and Swakopmund with their water.

Tufa is a spongey porous rock formed when water which has been in contact with limestone or dolomite churns down a river, mixing with air. Huge deposits of tufa can be seen where canyons meet big valleys.

Geology creates habitats

The cooler, wetter micro-environments in the Naukluft Mountains support a diversity of plant species that usually only survive farther south, including trees that take advantage of year-round water in mountain springs. These riparian zones welcome a variety of migrating birds. These sources of water and food have harbored humans and animal life for millennia.

Hartmann's Mountain Zebra have sharp hooves adapted for climbing steep rocky slopes. Their dust bathing behaviour produces shallow depressions with finer soil, which are favorable for plant growth and pollinating insects.

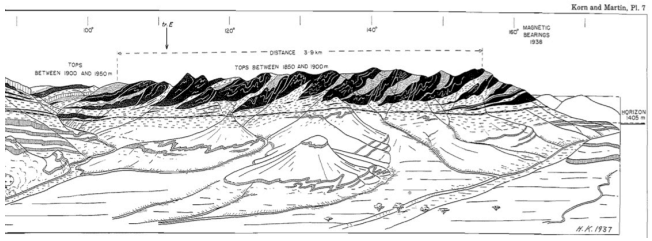
Aquila verreauxii, the black eagle, hunts in pairs for rock hyraxes (dassies) - it's favorite meal. Hundreds of resident and migratory bird species can be spotted in the Naukluft Mountains.

Succulents perch on the Naukluft slopes. *Euphorbia virosa* (Gifboom) forms a tall cluster of spiked stems filled with poisonous sap. *Aloe dichotoma* (Quiver tree) and *Moringa ovalifolia* favor rocky outcrops with sweeping views.

Layers of dolomite stacked up by thrust faults, Die Valle

Geological history in the Naukluft

In the 1930s, H. Korn and H. Martin recorded the structure of the Naukluft without digital technology. Although global advances in science have led to better understanding of geologic processes, their observations have stood the test of time.



Sketch of stacked dolomite layers by Herman Korn

Korn & Martin's observations revealed a master detachment - a thin layer of yellow dolomite dividing younger rocks below, from older rocks above (seen as a black/white striped line in Korn's sketch). This detachment is now known as the Naukluft Thrust.

In recent decades, there has been increased research interest in the Naukluft Mountains. Here, the the sedimentary rocks preserve records of early Earth climate and the first appearance of animals in the seas. Ancient faults contain records of great earthquakes that helped build mighty mountains, now mostly eroded away. Tufa deposits preserve the records of changing climate and habitat for people, plants and animals. The Naukluft Mountains are increasingly critical keystone in supporting groundwater supplies for the region as well as an important resource for wildlife conservation and tourism.

Geology of the Naukluft Mountains

a brief visitors' guide

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