

# Lesotho's rivers now flow to the north



Uwe Kalz, DMT engineer, at work in Africa,  
carrying out a gyroscopic survey





The Katse Dam was completed in Building Phase 1 and commissioned in 1998



Uwe Kalz loves his job as a land surveyor. About twice a year he can pack his bags and set off for exotic climes. His passport is adorned with stamps from Taiwan to Chile. His last trip, in November 1999, took him to Lesotho, an independent kingdom in the middle of South Africa. "We have been working on the Highland Water Project since the beginning of the 90s", relates Uwe Kalz, land surveyor with Deutsche Montan Technologie, the joint research institution of the German coal industry.

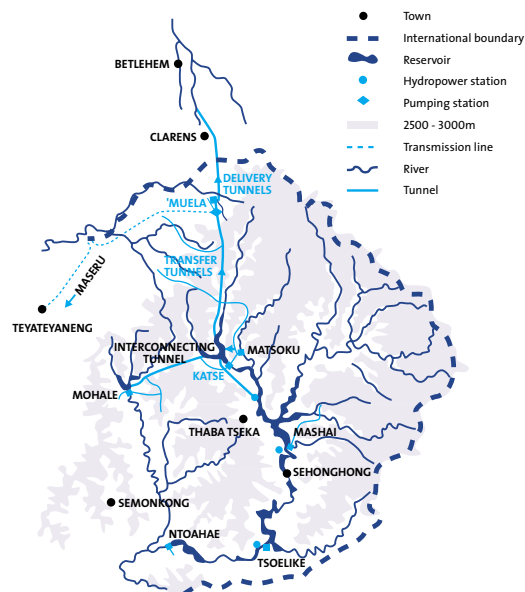
Lesotho is very close to the heavens. The highlands make up part of the Drakensberg, and even the valleys are at an altitude of over 2,000 meters. The clouds moving over the surrounding flat South African terrain are held up here and deposit their moisture, feeding the waters of the Orange River which becomes very swollen at times. This vital water artery and its branches have carved valleys up to 800 meters deep out of the mountains. Due to the topography of this breathtaking country, the water flows away to the south-west. Too bad for the growth region of Johannesburg, which lies to the north of Lesotho. None of the precious water reaches there. And that is why the Johannesburg area suffers from a chronic water shortage.



Surveying work in the tunnel

The predominantly farming population of Lesotho, on the other hand, has so far been using less than ten per cent of the water. So the obvious course of action was to sell the water.

A tunnel was required to divert the water to the north. For thirty years Lesotho and South Africa negotiated over the agreement on



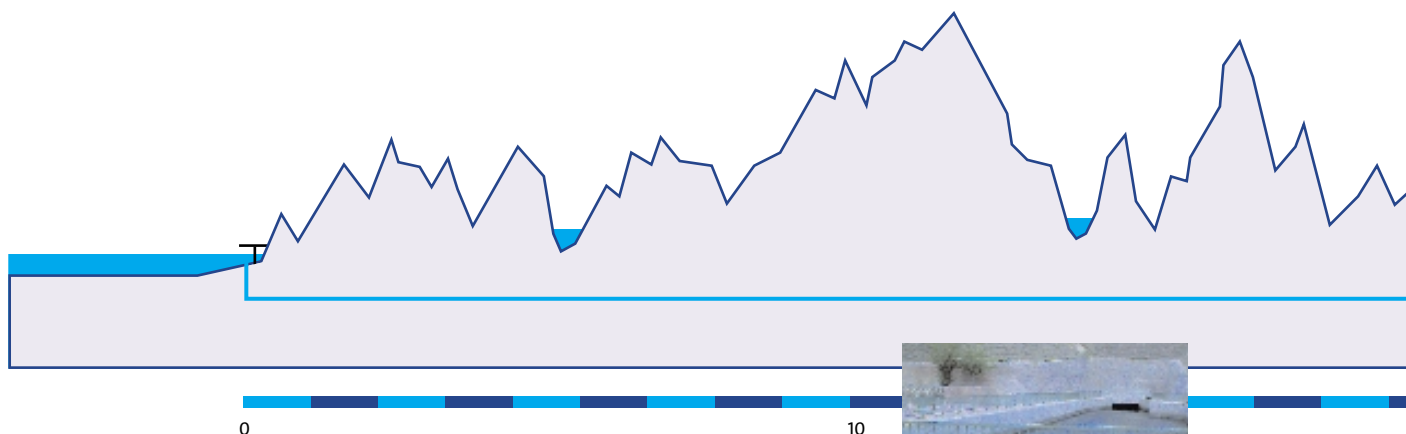


Calibrating the Gyromat 2000 under the African sun at the construction site of the Mohale Dam

the Highland Water Project before finally signing it in 1986. A first phase saw the construction of the Katse Dam by 1996, which now holds 1,950 billion cubic meters of water. From there the precious water travels north along a ca. 80 kilometer long tunnel cavity, after which it is channeled into the Ash River in Clarence, on South African territory. In this the water from Lesotho then flows to Johannesburg. "At the same time Lesotho also received its first hydroelectric power station", says Uwe Kalz. This poor small state can also sell South Africa a large part of the electricity generated here.

"In order for the Katse Reservoir to have a stable water level in drier years too, other rivers are also being diverted to the north",

explains Uwe Kalz. A 32 km tunnel cavity, which leads away from the recently built Mohale Dam, is currently under construction. From both tunnel ends, boring heads measuring 300 meters in length gouge their way through the rock like giant worms. For the tunnels cavities actually to meet, it is necessary to carry out precise surveying work. Building on the need and experience in German coal mining, the precision gyro-theodolite "Gyromat 2000" has been developed for such measurements. Its predecessor had already been used in the construction of the Eurotunnel which connects Great Britain with the European mainland. The Gyromat 2000 registers geographical "North" with a maximum deviation of 1.5 cm per kilometer. Since it takes its bearings from the earth's axis, the compass cannot be deflected by the magnetic fields of ores found in the earth.





Tunnel exit into the Ash River on the South African side

"The engineers we have working on site are specialists in their field", says Uwe Kalz, "but we also have by far the most precise instrument in the world, without which this precision work would not really be possible." With 24 control measurements in a tunnel section 2.5 kilometers long, the Gyromat 2000 shows a deviation of ten centimeters. "The subsequent borings have to be corrected by this amount, otherwise the tunnel cavities will meet each other at an angle", says

Kalz. The many measurements and calculations have so far prevented Uwe Kalz from getting to know the country and people beyond the construction site camp better. "I am planning a vacation in South Africa", says the engineer. But first he faces another business trip to Lesotho – to check the measurements.

#### F A C T S

##### The Gyromat 2000 precision gyro-theodolite

- Inside it there is a freely suspended, quickly rotating gyroscope. The interaction of the gyroscope's spin, the gravitational pull of the earth and the earth's rotation causes the Gyromat to point to the North.
- The accuracy is 1.5 centimeters per kilometer.
- It works fully automatically, no manual provisional settings are required. The evaluation of the measurement process is also done automatically.
- The Gyromat 2000 takes only nine minutes to carry out a direction measurement.
- An integrated accumulator allows up to 40 measurements.
- It weighs eleven kilograms without the theodolite.
- It can be used in temperatures ranging between - 20 °C and + 50 °C.

