

Water is the ultimate essential for life. As the planet warms, many of us can expect this vital resource to become more scarce.

Alan MacDonald and **Nick Robins** describe how the work of the hydrogeologist may soon be the key to preventing conflicts between arid countries.

Water for life

Water is not only essential for our wellbeing but also for the wellbeing of every living organism on the planet. Current climate uncertainties underline the delicate balance between equitable and adequate access to safe water and scarcity caused by drought. While the word 'adequate' may mean a hosepipe ban for residents in the Thames Valley, it means life or death in the semi-arid parts of the world. Increasing water scarcity affects poorest people the most. It also has an impact on our habitats and ecosystems which struggle to cope with the changing environment.

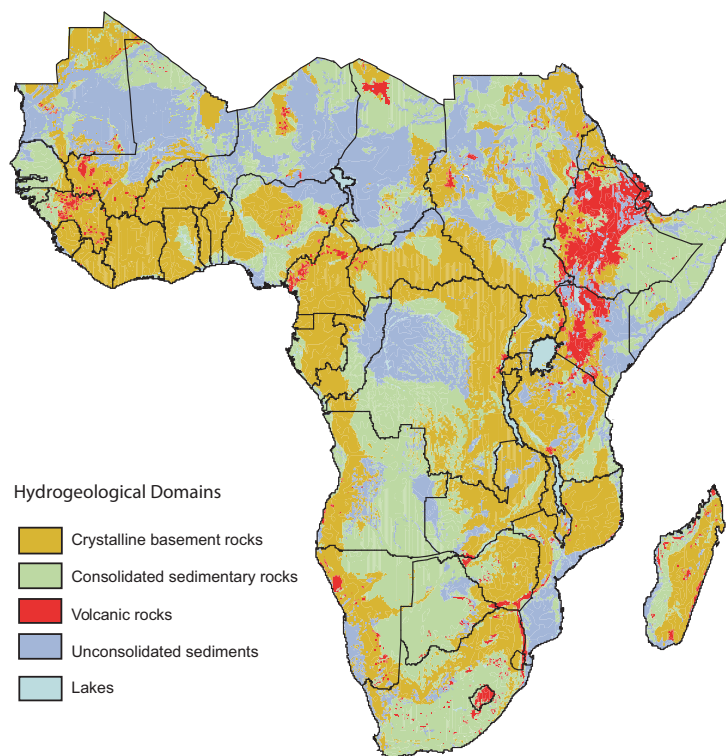
Sub-Saharan Africa has the least available water resources of all inhabited continents, as much of the rainfall evaporates, or is used up by the soil. This makes Africa one of the most delicately balanced areas of the world. The situation is getting worse: long-term rainfall is declining (e.g. 30 per cent in Harare, Zimbabwe, since the 1940s) and the area affected by severe drought is increasing markedly.

“ as climate becomes more erratic and unpredictable the hydrogeologist can help to secure the balance between supply and demand, not only in Africa but throughout the planet as a whole ”

As rainfall and river flows are seasonal and increasingly unreliable, emphasis has long been placed on groundwater for safe water supplies. Groundwater responds slowly to drought, so is often available when other resources have dried up; it is also naturally protected by the soil cover against pathogens and many other contaminants.

Groundwater supplies are not only key to many of the large urban areas, such as Pretoria, Lusaka, Kampala, and Dar es

Salaam, but more importantly they are the only reliable source available to the many and dispersed rural communities of the region. Sub-Saharan Africa has a population of 750 million of which more than 64 per cent of are estimated to live in rural areas. Groundwater is not only essential as a supply of safe drinking water in rural areas, but also in supporting small household industries such as brewing, brick making, or community



Hydrogeological environments in sub-Saharan Africa. Crystalline basement rocks support the largest rural population (250 million) and volcanic rocks support the least (50 million). The ability to find successfully and develop groundwater depends critically on the hydrogeology.



More than 270 million rural people in Sub-Saharan Africa have no access to safe water, and have to walk long distances to collect poor quality water from streams or ponds. Groundwater, accessed through borehole or hand dug wells, is often the only realistic option for water supply in rural communities across Africa.

garden projects, which may help to lift rural households out of poverty.

However, much of the semi-arid lands of sub-Saharan Africa are underlain by rocks in which groundwater resources may be hard to find (such as ancient crystalline basement rocks and mudstones). Or natural chemicals, such as fluoride or arsenic, may be present in the water at levels that are bad for health. This is one of the reasons why 270 million people in rural Africa still do not have access to safe

and reliable water supplies. In these areas special techniques are required to identify optimum places for the development of sustainable and safe groundwater supplies.

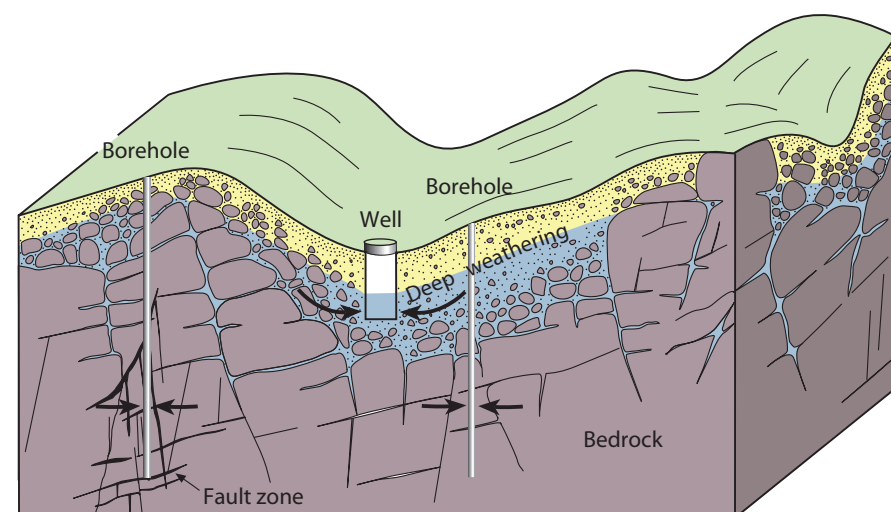
The maintenance of water for life in this important region falls firmly on the shoulders of the hydrogeologist. In collaboration with the social and economic experts, who assess water demand and the optimum use and management of available water resources, hydrogeologists are needed to work out how to locate and

develop groundwater resources sustainably. To do this, they are armed with a variety of tools, such as geophysical investigations and remote sensing, drilling rigs, pumping tests, and chemical analysis. They also use a variety of secondary indicators, such as vegetation changes or the occurrence of termite mounds.

The BGS maintains considerable expertise in arid and semi-arid hydrogeology, not least in sub-Saharan Africa where they have worked for some 50 years in a wide range of English- and Portuguese-speaking countries. These skills will be increasingly called upon as our climate becomes more erratic and unpredictable. The hydrogeologist can help to secure the balance between supply and demand, not only in Africa but throughout the planet as a whole. The science of hydrogeology has an important part to play in keeping the often talked about water war scenarios between neighbouring nations at bay and in sustaining the livelihoods not only of the poor of Africa, but of the richer nations in the north as well.

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In crystalline basement rocks, groundwater occurs in fractures or where the rocks have been deeply weathered. The BGS has helped develop techniques to improve the siting and sustainability of wells and boreholes.