



Zambia, a dried-up arm of the Luangwa River on the border with Malawi, 2022

Interview with doc. RNDr. Zbyněk Hrkal, CSc., hydrogeologist, writer, and populariser of water management

The October issue of the VTEI journal deals mainly with groundwater and its management. We therefore discussed the promotion of this topic with a colleague who is engaged in research in groundwater, has been lecturing on hydrogeology for a long time at the Faculty of Science, Charles University in Prague, and deals with the topic of water management in his publications. "The main problem in the world is not a physical lack of water, but poverty, illiteracy, and economic backwardness," says Zbyněk Hrkal.

Mr. Hrkal, you have been popularizing hydrogeology and water management for a long time. Why this topic?

I will start with a little detour. The aphorism "publish or perish" has been used since 1928. For this reason, among others, scientists have recently been under increasing pressure to publish the results of their research. The quantity and, above all, the quality of the articles becomes a criterion not only for the quality of their work, but also for the professional status of their institution.

I will give one classic example. Almost everyone in the world knows Robert Koch, a German doctor and microbiologist, winner of the Nobel Prize for Physiology and Medicine. After all, he was the one who discovered the cholera bacterium. However, it is not entirely true. Indeed, Koch was the first to publish the results of the origin of this deadly bacterium, thus gaining immortal fame. However, in 1854, 30 years before him, the causative agent of cholera – *Vibrio cholerae* – was isolated by the Italian anatomist Filippo Pacini. But he remained in the laboratory with his discovery and died in poverty and oblivion. He got some recognition only recently.

An important conclusion can be drawn from this: even if they are brilliant, scientists who keep their results "in a drawer" are almost worthless for their institutions, as well as for society in general.

Indeed, but you are talking about professional publications; I rather had in mind the popular-scientific ones, intended for the widest readership. Is it difficult to move from the professional position of a researcher to a level understandable to the common layperson?

Not every top expert – and now I am speaking in general, no matter the field – is able to present their results in a comprehensible manner. They may have dozens of publications in the most prestigious professional journals on their list, but when it comes to conveying the results of their work to ordinary people, no one understands them. It is extremely difficult to find a compromise between professional language and expression understandable to the layperson. The so-called vulgarization of professional text must not occur, which unfortunately we often witness in our media. Journalists read a professional article and, without understanding it, translate it, in their opinion, into the so-called vernacular. The result is "packaged" for the reader in an attractive graphic form, and the popular article is also given a provocative title. The result is a very bad example of how professional literature should be handled. But the opposite example is also bad, when a renowned expert takes up the pen and overwhelms the readers with a whirlwind of professional, often completely unnecessary terms. Although the result is different from the first example, the effect is similar; being able to write a professional text so that it is not only comprehensible, but above all readable and interesting for a layperson unfamiliar

with a field is extremely challenging. With a bit of exaggeration, I would say that it is a separate, completely specific literary discipline. It is all the more challenging in the case of hydrogeology, because the subject of our research – groundwater – is not (with rare exceptions) visible.

But you have been dealing with it for many years...

So far, I have published ten books, while the most read ones are from the scientific-popular category. In them, I try to disprove a number of old myths that journalists keep reviving, such as scaring the population that the planet will run out of water. Sometimes it feels like a battle with windmills. I can emphasize endlessly that water on Earth never runs out, it just moves from one corner to another, or changes its state. The next day, however, I open the newspaper and again read a headline with a similarly catastrophic title.

This is why I find popularizing the results of our scientific work enjoyable and fulfilling. I have had a very good response from readers of my books and listeners of my media appearances. I have already received various prestigious literary awards for three books, all of them are selling well, and their dramatizations by the expert in his field, actor Tomáš Töpfer, have had over 200,000 listeners in the Meteor programme on Czech Radio.

What are you working on at the moment?

As far as my popularization activities are concerned, the highlight so far is probably the film project *Water Stories*. Based on my books, I wrote a script for a film documentary that presents water as one of the most important phenomena shaping human civilization. The film will be made by the Twinstars studio of filmmaker Steve Lichtag, who is world famous for his documentaries about marine life. In eight parts, the *Water Stories* documentary takes the viewer to various places on the planet (China, Sahara, Nepal, Dubai, Israel, etc.). The series presenter will be Taťána Kuchařová, ambassador of the UN Sustainable Development Goals programme. National Geographic became the general partner, which will also distribute the film on its network.



Namibia, with Herero women, 2017

What was your starting point, your career path?

I started my professional career at the then Central Institute of Geology in Prague. Then I moved to France, where I worked for two years at BRGM in Orléans and later at ANTEA. After returning to the Czech Republic, I started working at my alma mater, the Faculty of Science of Charles University, teaching hydrogeology and water management. However, teaching activities did not prevent me from participating in foreign projects. For my former French employer, I led projects in Kazakhstan and Siberia. For my job, I visited India, Nepal, Kyrgyzstan, Israel, and a number of other, mainly developing countries. I am still at Charles University; however, my main job is currently at the Water Research Institute.

In terms of water management, which other countries could we take an example from?

Israel should definitely inspire us. The speed with which new water management technologies are developed and put into practice is admirable. Thanks to them, Israel became the first country to stop depending on atmospheric precipitation. Even if it hypothetically stopped raining, Israelis can be incredibly economical with water, they know how to recycle water almost endlessly, and in the worst case they can produce it cheaply from the inexhaustible source, which is the sea. So, when my Israeli colleagues visit the Czech Republic and I talk about our issues with drought, they usually smile indulgently. Israel demonstrates my long-presented idea that all issues related to water scarcity are currently technically solvable. The main problem is not the physical lack of water, but poverty, illiteracy, and economic backwardness.

What about the topic of artificial and bank infiltration, which you have been dealing with for a long time?

This is one of the topics that is related to the previous question. It is a technology that simulates and intensifies the natural process of transforming surface water into better quality groundwater. At the beginning of the twentieth century, we were already worldwide pioneers of this water management process in the Káraný area. In 1968, we supplemented the original process of bank infiltration with today's perfectly functioning artificial infiltration system. At that time, our water management was at the top of the world. Since then, however, only repetitive preparatory studies have been created, but no similar project has yet been implemented.

You also study the occurrence of micropollutants in groundwater, such as pharmaceuticals and microplastics. What are the latest findings in this issue?

It is true, the issue of the presence of pharmaceuticals and recently also microplastics, especially in drinking water, has recently become my main activity. After a long time, it is a new water management challenge, because thanks to the leap in development of analytical chemistry, the door to a completely unknown world has opened before us. A few years ago, we had no idea that specific substances could be present in the aquatic environment in concentrations of tens of nanograms per litre, which, in rough comparison, represents a drop in a swimming pool. We now know about dozens of pharmaceuticals that are quite commonly present in all European rivers and represent a kind of "natural" background. These substances penetrate into groundwater and are also found in drinking water. The problem is that this is an interdisciplinary question. A water manager can describe in detail the behaviour of these substances in aquatic and rock environments, characterize their transformations into subsidiary products, but in the end, they always encounter the limits of their own knowledge. We ask ourselves a question that we cannot answer. The question is: are the concentrations of substances that we have described in such detail dangerous for human health? We have hundreds of scientific studies on negative impacts on fish

stocks and water-bound ecosystems. However, we still know very little about how these specific micropollutants affect the human body.

Where do you see the future of your field?

Definitely in interdisciplinarity. We have before us a number of questions, in many cases of a very fundamental nature, the solution of which will require a change in established scientific procedures. It will be necessary to connect scientific disciplines whose cooperation was considered unlikely until recently. The scientist will have to place the achieved results in the widest possible context, including the often neglected economic one. I am personally convinced that a completely new world can open before us, for example, by connecting medicine and hydrogeology. As an inspiration, I can mention studies from Japan and the USA, where collaboration between hydrogeologists and doctors demonstrated a statistically significant impact of increased lithium contents in drinking water on crime reduction. This metal, commonly used in psychiatric practice, reduces aggression. We can build on the long-term successful cooperation with doctors in the field of mineral waters. However, in my opinion, there are a lot of discoveries hidden in the issue of micropollutants, which can move human knowledge in perhaps unexpected directions.

Mr. Hrkal, thank you very much for the interview.

Mgr. Pavel Eckhardt

Doc. RNDr. Zbyněk Hrkal, CSc.

Doc. RNDr. Zbyněk Hrkal, CSc., born on 1st March 1957 in Prague, studied hydrogeology at the Faculty of Science, Charles University in Prague, and Francophone culture at the Faculty of Education of Charles University. After graduating in 1981, he joined the Central Institute of Geology in Prague, where he dealt with the hydrogeological issues of nuclear waste repositories. In 1991, he moved to France, where he worked first in the French geological survey BRGM, based in Orléans, and later in its privatized branch, ANTEA. The main goal of his work was the application of GIS in dealing with hydrogeological issues. After returning in 1992, he joined the Department of Hydrogeology of the Faculty of Science, Charles University in Prague as a teacher and researcher, where he completed his habilitation in 2003. In parallel with his academic work, he continued to cooperate with ANTEA on foreign contracts, ecological audits on the Irtysh River in Kazakhstan in the Ust Kamenogorsk region and Semipalatinsk, and later also in Russia in the vicinity of Omsk. Later, he led projects focused on the issue of Borjomi mineral waters in Georgia and for the international group IDS in Ukraine. As part of development aid projects, he worked in Nepal, India, Saudi Arabia, the Palestinian Territory on the West Bank, and other countries. In 2003, he came to the Water Research Institute as a researcher, where he led the Department of Hydrogeology. However, he has maintained his teaching activity at Charles University, as well as at French universities, to this day. His professional long-term focus is on two areas – artificial infiltration and micropollutants in surface and groundwater, especially pharmaceuticals and microplastics. In this context, he led a number of domestic projects (TA CR) as well as foreign ones (Horizon and Interreg).

