But Don't Bulldoze Away the Evidence

Aerial Photos—A Modern Water Sniffer?

Booming towns and cities may be bulldozing away the best evidence they will ever get as to the presence beneath them of abundant sources of fresh water.

The warning emerges from the development of a new method of prospecting for ground water — from the air.

Seven years ago Dr. Richard R. Parizek, Pennsylvania State University, and Dr. Lawrence H. Lattman, now at the University of Cincinnati, published their discovery that zones of highly fractured rock containing significant quantities of ground water reflect their presence in subtle surface traces best detected on aerial photographs.

One of the geologists actually learned to fly in order to pursue the research. The method has proved almost spectacularly successful:

". . the last six community and industrial wells," a report reads, "intentionally located by this method . . . had a combined tested capacity of seven million gallons per day and a conservatively projected combined capacity of more than 11 million gallons per day. This is enough water to supply a population of 61,000 . "

But fracture traces — lines of vegetation, changes in soil tone, surface sags, straight valley alignments, etc. — can be wiped out by a bulldozer.

"Urban areas or mushrooming developments, which have the greatest need of dependable water supplies," says Parizek, "are almost impossible to prospect using aerial observation techniques. Once fractured trace clues have been obliterated, the water prospector often has little recourse but to fall back on random drilling methods.

"By the simple expedient of taking aerial photographs (or filing existing ones) before disturbing the land, cities, developers, or private individuals could preserve a record of the topography that would be invaluable to geologists selecting well-sites, years later, using the fracture trace method "

Despite the predominance of bulldozers, the new method is now proving out in many parts of the country: communities hard-pressed for fresh water are able to open gushing wells in rocks which were previously considered poorly productive.

In most rock, a system of "conduits" or joints has developed over centuries, allowing subsurface flow and chemical leaching. These joints are interconnected in what amounts to a vast underground plumbing network. Ground water tends to gather in these conduits and where two or more joints — or zones of joints — meet, more water is usually found

Fracture traces show up on aerial photographs as obscure, narrow lines and straight alignment of features. Still, such lines often denote continuous zones that may be almost a mile in length and as much as 50 feet wide: veritable "rivers" beneath the ground.

Consequently, the fracture trace method can consistently pin-point well sites that yield significant and often spectacular quantities of ground water.

Where randomly picked sites produced wells with one to 100 gallon-per-minute yield, the new method has produced wells — in the same rock, often only a few yards away — yielding 500 to 2,500 gallons per minute

The Pennsylvania State University, where Parizek and Lattman made their studies, routinely uses the fracture-trace technique in looking for water on its own property. So does the borough of State College, where the Penn State main campus is located. Many other communities are following suit.

A well with anything less than 500 gallons per minute is considered a "dry hole" by University and borough officials.

"Of the last 13 wells drilled in the area," reports Parizek, "only one had a yield of less than 500 gallons per minute." All the well sites were located by the fracture trace technique.

Parizek and Lattman caution that aerial photography alone is not enough. Field studies are highly desirable and test borings are often used to verify the data assembled from aerial observation. Also, an intimate knowledge of the geology of the region is essential.

The new method, besides locating prime water-well sites, helps to characterize the subterranean "lay of the land:" document its physical condition. This has important engineering applications: foreknowledge of the presence of highly fractured and decomposed rock could help keep tunnels, mines, highway cuts, sky-scraper or ordinary building excavations from being flooded by ground water or being damaged due to poor foundation conditions. In addition, the method can be used to locate areas where excessive leakage may occur beneath dams and reservoirs.

The Parizek-Lattman method begins to put water prospecting on a par with oil prospecting as far as scientific underpinning is concerned.

"With the demand for fresh water now world-wide," says Parizek, "something had to be done to get water prospecting in fractured rock out of the 'forked-stick' stage. The water-yielding potential of most rock and soil strata can be enormous. Their waters are constantly replenished by rain and snowmelt, by underground flow, or by seepage from lakes and rivers. The supply is not unlimited, or course — and our research is now geared to finding out just how long it might be before a given well or well field constructed on a fracture zone runs dry.

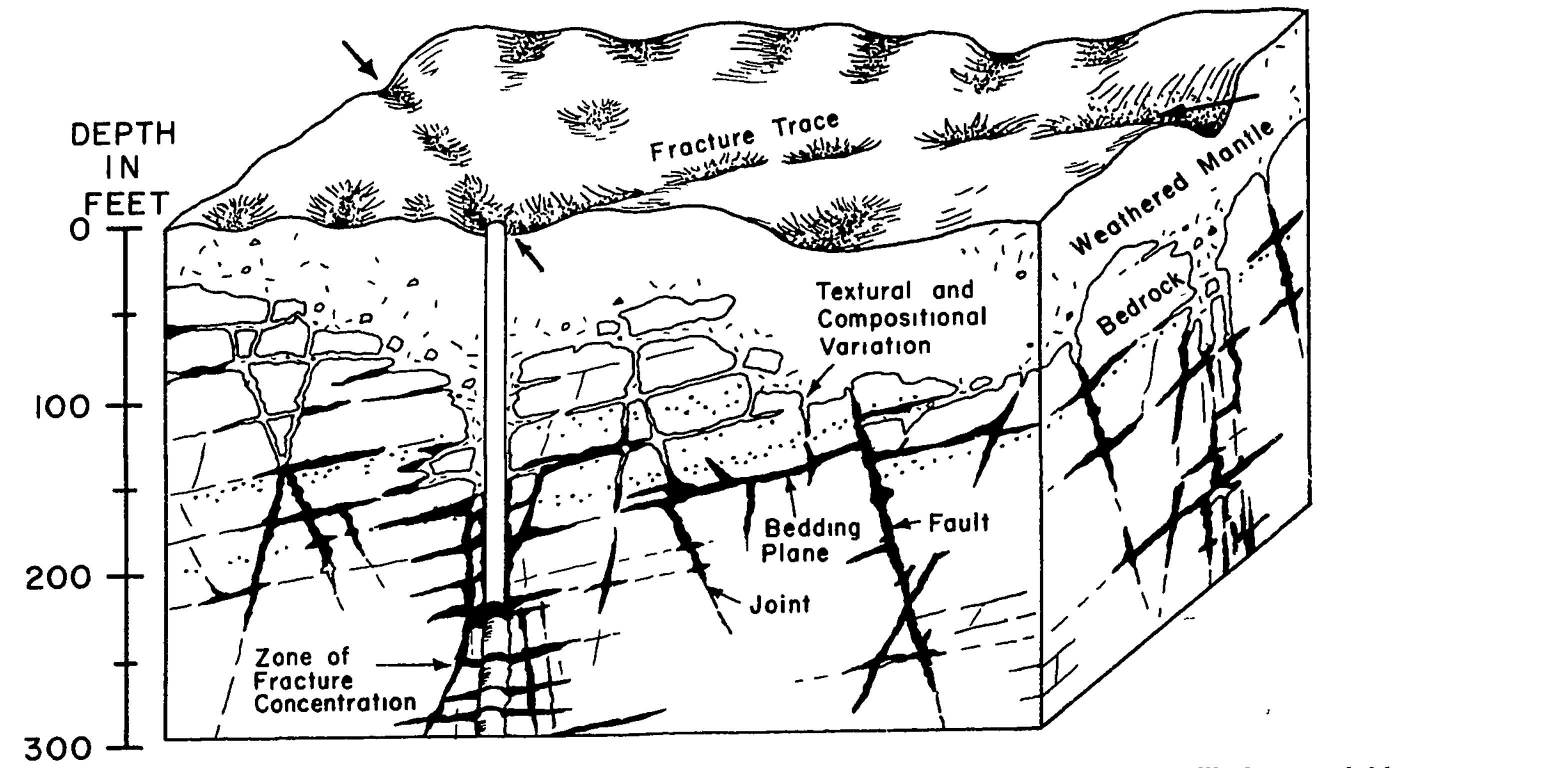
"But water in significant quantities is often there for the asking; we just need to know more about how and where to 'ask'. This may impose a challenge to drillers, who often encounter severe broken-rock conditions, but the water is there."

Research on the technique is continuing under a grant from the Mineral Conservation Section at Penn State and with support from the University's Institute for Research on Land and Water Resources.

Dr. Parizek is professor of geology and assistant director of the Mineral Conservation Section. Working with him at Penn State are Dr. Shamsul H. Siddigui, Dr. Barry Voight, Dr. Shelton Alexander and Dr. Richard Merkel, all of the College of Earth and Mineral Sciences.

George C. Cline, Robert L. Brown and Larry Drew, former graduate research assistants, also worked on various aspects of the project.

Over 2,500 reprints have been distributed of the first major publication of findings by Lattman and Parizek (1964).



Nature's subterranean plumbing reveals itself by subtle lines on the earth's surface, normally visible only from the air. Two Penn State geologists spent 10 years perfecting the "fracture trace" method of prospecting for groundwater and can pinpoint well-sites which, when drilled, may yield up to 3,000 times more water than wells chosen at random. Fresh water tends to gather in decomposed rock zones, and where two or more zones intersect more water is usually found.