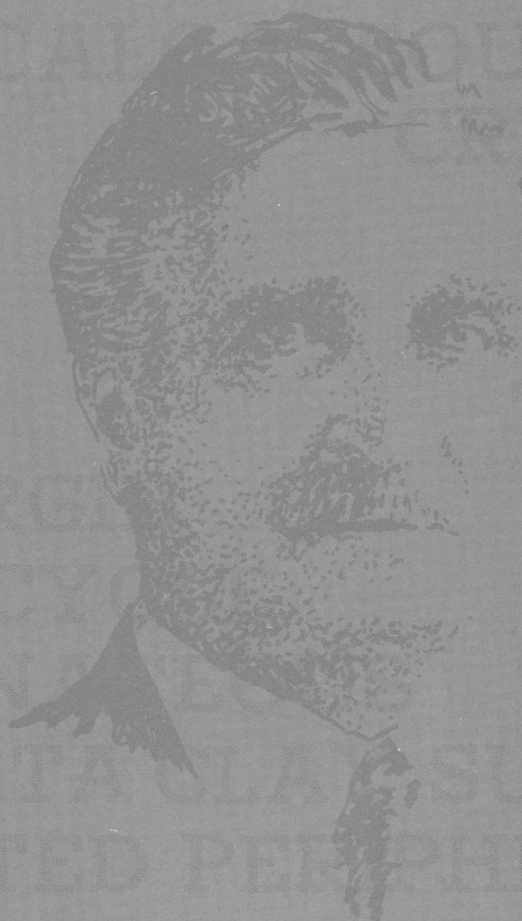
As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. administration.

Plain Geology



U.S. Department of the Interior/Geological Survey

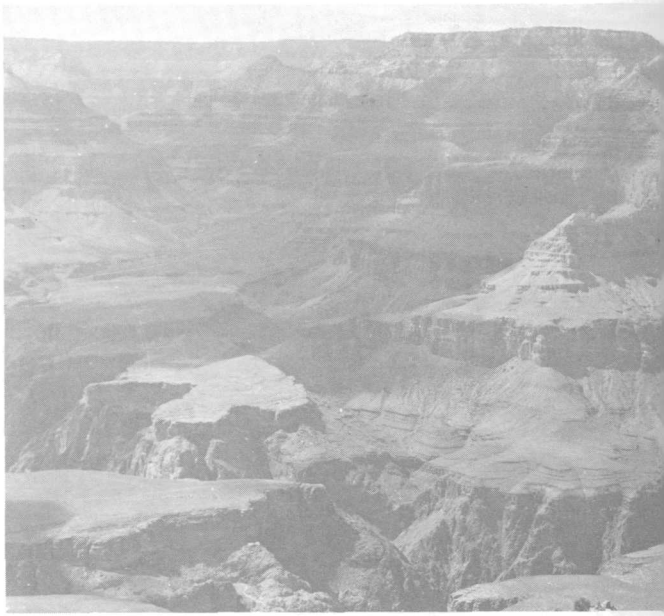
Plain Geology

by George Otis Smith

The scientific community must be effective in communicating the results of its work to the public in a way that can be understood and used. The need for this is acute, for the complexity and difficulty of environmental and resource problems require full use of all the knowledge scientists can muster. The wisdom of the actions of both the government and private sectors depends in large part on their understanding of resource characteristics.

The U.S. Geological Survey is uniquely qualified to provide much of the required knowledge about natural resources through its many reports and maps and can be proud of the products of its work. Too often, however, reports are couched in words and phrases that are understandable only to other scientists, engineers, or technicians. But, who, really, are the ones to whom the Survey wishes to convey its findings? Other scientists and engineers, yes. But beyond them, by far a larger audience: teachers, students, businessmen, planners, and Federal, State, county, and municipal officials—in short, the public.

More than 50 years ago former Director George Otis Smith (shown on the front cover) recognized the same problem. His plea for "Plain Geology" was a classic, just as applicable now as it was in 1921. It is herewith reprinted to make it generally available.



The Grand Canyon, Arizona.

Some years ago I spoke to an audience of mining men on the subject of plain writing. My talk was an appeal for the simple and direct statement of scientific thought in popular language; but that appeal was addressed to consumers of geological literature, and I should probably do better to make a similar appeal to some of the producers of geological literature.

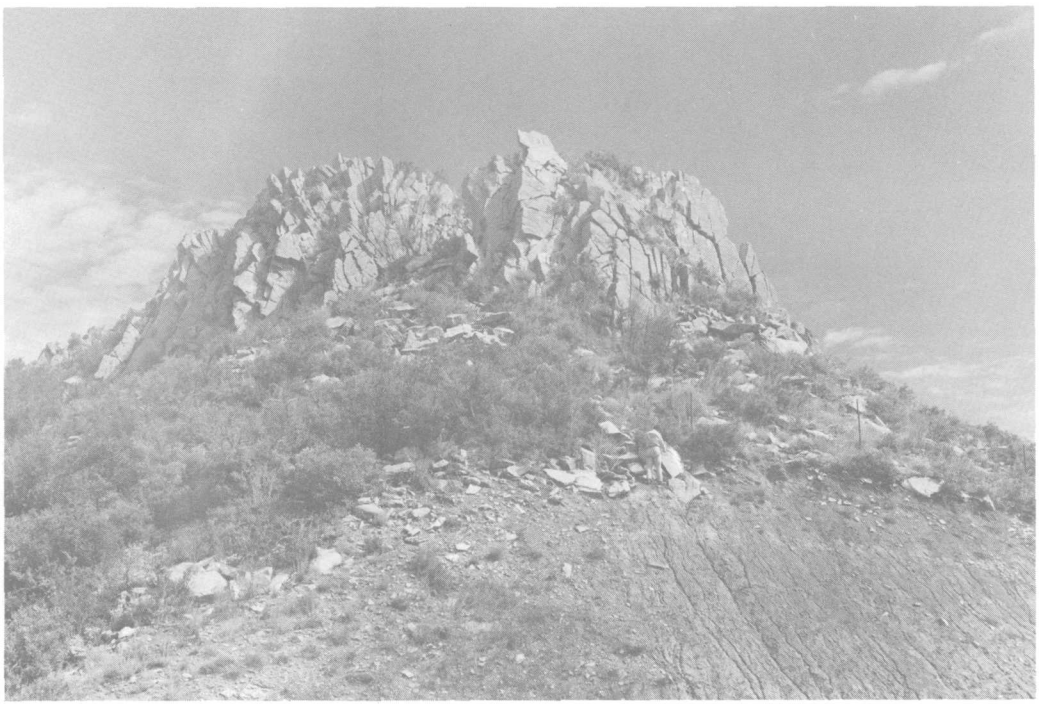
Geology has of late been presented to the public in so many new aspects—commercial, military, political, and even legal—that he would be bold who would add to its modern varieties; therefore I ask here only a return to a primitive type, and my topic is "Plain Geology."

I am convinced that, at its best, science is simple—that the simplest arrangement of facts that sets forth the truth best deserves the term scientific. So the geology I plead for is that

which states facts in plain words—in language understood by the many rather than only by the few. Plain geology needs little defining, and I may state my case best by trying to set forth the reasons why we have strayed so far away from the simple type.

First of all, I suppose we may as well admit a certain liking for the sound of words, and the longer the word the more sound it has. Especially enjoyable is this mild form of hypnotism if both ideas and words are such as to make us feel that we are moving in the highest circles. At the meeting of the British Association this year one physicist frankly explained that the idea of relativity is popular because to most people it is "pleasantly incomprehensible." It was a hardened reader of manuscripts who confessed that he liked to hear a psychologist talk. "Of course, I understand not a word he is saying, but it is a noble and inspiring spectacle to see a mere human being crack a whip over an entire vocabulary and see the words jump up on their little red chairs like so many trained seals." But, as I wish to suggest, doing tricks with words may be more entertaining than really useful.

Again, I fear lest in our writing we lose sight of our audience, if, indeed, some of us ever see at all the audience to whom we address our written reports. The chief purpose of words is to convey thoughts, and unless the wavelengths of the words are right the receiving apparatus will utterly fail to pick up the thoughts. How easily we can underestimate the difference in vocabulary between our audience and ourselves was brought to my notice recently when I heard a brother geologist speak at a dinner to a large group of oil operators, highly intelligent but not broadly educated men, to most of whom the oil business was simply a profit side line. I thought the talk unusually free from the technical terms so commonly used in the inner circle of our fraternity, and was therefore surprised when a table companion remarked that this talk didn't get across because it included many words not understood by the majority of those who heard it. I asked for particulars, and he at once specified *periphery*, a word the speaker had repeatedly used in describing where to test out this or that oil pool. "Half of those people don't know what *periphery* means," said this gentleman, who knew the audience better than I did, and I saw that he was right; and then I realized how much better that common everyday word edge would have served—so many things have edges and to so few do we need to attribute peripheries! And when we come to think of it, we realize that edge is a sufficiently exact term to apply to an oil pool, the position, shape, and extent of which we know only in very general terms.



The public better understands what cracks and crevices are than *spaces of discontinuity.*

This brings me to a third reason for our use of highly technical language; we too often try to overdress our thoughts. Just as there is a somewhat prevalent notion that clothes make the man, so we subconsciously believe that words make the idea. We follow the precept, "To be scientific, use scientific terms," and in so doing we deceive ourselves. I do not wish to be unduly autobiographic in this analysis, but to show my true sympathy for those whose practices I denounce, I confess that I, too, have had the unhappy experience of stripping the technical words from what looked like a good-sized geological deduction only to find that the naked idea was rather small and not my own. It is also a common experience to make the sad discovery that a piece of involved and obscure writing is simply the product of roundabout reasoning or twisted thinking. Our own words fool us, and unconsciously we cover up with long words or tangled rhetoric our lack of plain thinking.

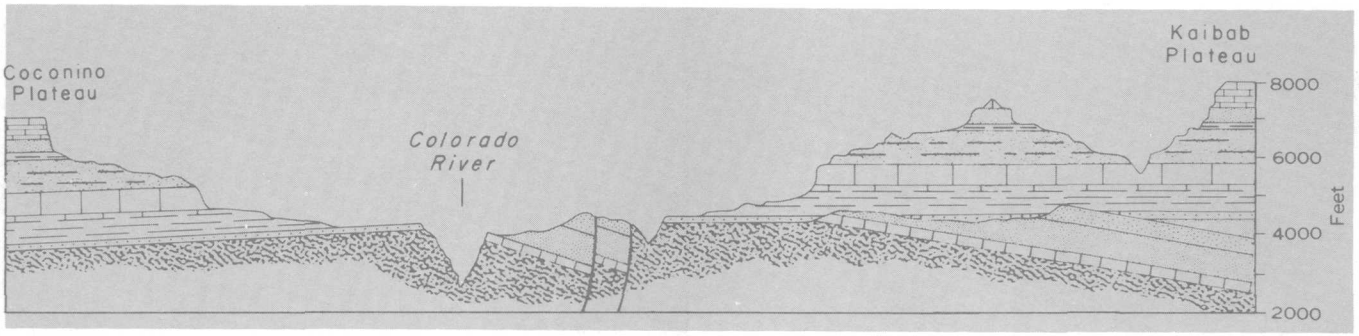
In picking my samples of the wordy sins of scientists, I naturally turn to the writings of my associates on the United States Geological Survey, not because they are the worst offenders but because they are sinners with whom I am best acquainted. Some of these writers, after setting down a technical phrase, realize the need of reaching their readers with words more easily understood and so translate their own scientific terminology on the spot; for example, one good geologist refers to "disseminated grains scattered through the rock," and another addresses the two parts of his audience with

Geologists should refer to close folding instead of *intense plication* and beds instead of *strata.*

this sentence, "Disintegration is slow in these rocks, and they do not break up rapidly." *Disseminated* and *disintegration* are words that please every ear, trained or untrained, while the garden variety of mind is helped along by the plain words scattered and break up.

It seems that in our hunt for general principles we feel the need of tagging each observed fact with some word that may connect it with the language in which the great fundamental laws of the universe are proclaimed at the seats of learning. For this reason—I prefer to suggest no other—a Survey author refers to cracks and crevices in rocks as *spaces of discontinuity.* I remember a long sentence in the manuscript of a report on a western coal field in which the fairly common fact that shale is softer than sandstone was stated with full acknowledgments to *differential erosion* and due respect for the *physiographic cycle,* terms very comforting to the graduate student at our greater universities, but not at all useful to the practical man trying to open up a coal mine in Montana.

It takes years for some geologists to break the fetters of this scholastic habit of using big words for small ideas. Probably every one of us has been guilty of sentences like the following, which appeared in a Survey manuscript: "The argillaceous character of the formation is very prominent in some localities, although it is usually subsidiary to the arenaceous phase." On being translated this means: At some places the formation includes considerable clay, but generally it is made up chiefly of sand.



A geologic cross section showing the structure of the Grand Canyon, Arizona.

In our writing I believe, however, we are tending to write more plainly—to say sand instead of *arenaceous deposit,* clay instead of *argillaceous stratum,* close folding instead of *intense plication,* river banks instead of *riparian borders,* mouth instead of *debouchure,* shore instead of *littoral margin,* and the overlying bed is limestone instead of *the superincumbent material consists of a stratum of calcareous composition.*

I even hope the day may come when more of us will say beds instead of *strata,* for the context usually shows that we are talking about rocks, not about furniture. I, too, love the sound of *strata,* but all the pleasure I get from it is wholly lost when those who strive to copy our learning speak of *stratas.* As a measure of our progress, I may quote from a Survey author of an earlier day, who referred to "autogenous hydrography on a vertically heterogeneous terrane"—truly a nut of a thought, which I'll not try to crack, lest I find it all shell. It was a Survey graduate, I believe, who defined *form value* as "an intangible quality expressing the broad applicability of the energy form in contrast to its theoretical thermal value as commonly expressed in B. T. U." Words fail me, either to translate that definition or to describe it, though I may apply to such language a few words used in another connection by a Survey writer: "This holds the promise of large potential possibilities."

But I do not wish to claim for the Federal Survey any monopoly in learned writing. It was one outside of our fold who urged me to use plain language at a meeting where we were both on the program. I tried to follow his excellent advice, but in his own address before a mixed audience I listened with rapt attention to sentences like this: "So now every legitimate evidence of fact and deduction points to the origin of microbic unicellular life in the moist, subaerated soil away from the direct sun; and the soils of today are alive—a mighty host—with such microbic creations existing under paranerobic conditions." Before such words I realized that I, too, was a layman, for what I heard was, in the words of the speaker, "difficultly intelligible," if, indeed, I might not appropriately adapt to my use other sounding words in the same address and frankly confess that such language "outstripped the early promise of my cephalic ganglia and left me hopelessly decephalized."

Technical terms have their places, and I am on record as admitting that exact scientific statement needs special terms, words that best keep their razor edge when used only for

hairsplitting distinctions. This limited use of a highly specialized terminology is wholly defensible, for it would be folly to throw away tools so well-fitted for special purposes, just as it is unwise to put them to everyday uses with everyday people. Transubstantiation, transpiration, and transgression are technical words that are useful enough to the professional theologian, biologist, and geologist, but they are code words that must be decoded before others can understand them. We know that a telegraphic code saves words for those who use it, but it also most effectively conceals information from the uninitiated.

I have a very definite purpose in this appeal for plain geology that a larger part of our people can understand. Today our science has more contacts with life than ever before: industry has taken geology into partnership, and engineers and capitalists and statesmen all look to geologists for advice. This greater demand has called to the ranks many with varying degrees of professional incompetence, a polite phrase by which I mean in plain English that some who call themselves geologists are knaves, others are fools, and yet others are hybrids. Now, the universal camouflage of the fake geologist—whether of the untaught or uncaught variety—is his protective coloring of technical words. To his clients or his dupes who are weak in geological knowledge these long and unusual words are impressive and serve his purpose, but to those who have had the advantage of special training and experience his use of geologic terms at once exposes his true character. Indeed, this is the basis of the practical test that some of us apply to the report in an oil prospectus if, as so commonly happens, we have never heard of the so-called "well-known authority on the geology of the greatest oil fields of the world." Such an expert uses all the

latest terms, but he mixes their meanings, his report is senseless, and we know him to be a faker. But I have yet to note the fake geologist imitating plain statements of geologic facts—that kind of masterpiece he doesn't attempt to copy. So I suggest this method of protecting our useful science from successful imitation; the economic geologist should tell his story in plain English, then because of the transparency of this statement his clients or the public can see things as they are and will learn to refuse the highly colored substitute offered by his quack imitators.

There is really somewhat of an obligation upon us, both as scientists and as partners in the world's business, to show the world that geology is not mystery or magic, but only common sense. I have told practical men of business that they should give little credence to the geologist who cannot tell his story in common language. The world has a right to discount our usefulness and even to distrust our honesty if we persist in concealing our thoughts, or lack of thoughts, behind a mask of professional jargon. The lawyers and the physicians whom I trust most can and do explain their technicalities to me in words that I can understand. Isn't plain geology the safest and most useful kind?

About the Author . . .

The foregoing paper was presented by George Otis Smith before the Society of Economic Geologists at the Amherst Meeting, December 28, 1921. Dr. Smith served as the fourth Director of the U.S. Geological Survey, from 1907 to 1930.

He was born on February 22, 1871, in Hodgdon, Maine. He graduated from Colby College in 1893 and received his Ph.D. in geology from Johns Hopkins University in 1896. He

joined the Survey as an assistant geologist in 1896, was appointed a geologist in 1901, and was named to succeed Charles D. Walcott as Director of the Survey in 1907, at the age of 36. He was the youngest man ever named to the post and his 23-year term was the longest of any Director in the Survey's history.

He became Director of the Survey at a time when the Government was becoming increasingly concerned with ensuring the wise use and conservation of the Nation's natural resources. Although the Survey continued its programs of pure scientific research, most of its efforts were applied to more practical concerns, such as the classification of Federal lands as to value for oil, gas, metals, and waterpower. This work assumed added significance during World War I, when oil and minerals were vitally needed as war materials and foreign sources of supply were threatened.

A highly respected scientist and a prolific writer, Dr. Smith was the author of numerous reports and papers on economic, petrographic, and physiological geology. In 1919 he edited and coauthored "The Strategy of Minerals." In his later years he chiefly devoted his efforts to studies of coal, oil, and waterpower, the major energy resources of the country.

Dr. Smith's public service was not limited to his work with the Survey. In 1924 he was appointed Chairman of the Naval Oil Reserve Commission. He also served as Chairman of the technical and advisory commission of the Federal Oil Conservation Board, and from 1930 to 1933 headed the Federal Power Commission. He was a member of the United States Coal Commission and a delegate to international geologic and engineering congresses in Mexico City, Stockholm, London, and Tokyo.

In 1920 he was awarded the Daly Gold Medal of the American Geographic Society. He

received the following honorary degrees: Sc.D. from Case School of Applied Science in 1914, LL.D. from Colby College in 1920, and Sc.D. from Colorado School of Mines in 1928. He served as a trustee of Colby College, the University of Chicago, Coburn Classical Institute, and Bloomfield Academy.

Dr. Smith was a member of numerous professional organizations, including the Geological Society of America, the American Institute of Mining and Metallurgical Engineers (president 1928-29), the Coal Mining Institute of America, the American Association of Petroleum Geologists, the American Forestry Association, the Washington Academy of Sciences, and the American Association for the Advancement of Science. His nonprofessional affiliations included Phi Beta Kappa, Delta Kappa Epsilon, the National Press Club, and the Cosmos Club, and he served as president of the Washington YMCA.

Dr. Smith died on January 10, 1944, at the age of 72.

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