

NEEDED: EXPLORATION INGENUITY*

By

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I am always delighted to be in Canada to visit with my Canadian friends, and like most Americans, I am genuinely and sincerely proud that you are our neighbors. We look at you with envy for many reasons — particularly because you still have so much opportunity for pioneering in all fields — especially in minerals.

In the area of petroleum exploration, you are just "scratching the surface." I believe the time will come when you will find in Canada as much or more oil and gas than we have found in the United States. You will do this, as we have done it: first, to meet the needs of your country, and, second, by the incentives necessary to make an investor reckless enough to take the risks involved.

Some of what I have to say here today refers to the exploratory situation in the United States at this time. It may not now apply to Canada but it can in a much shorter time than you might expect—if you don't guard against it. Also, I know that you will always feel the influence of any important petroleum trends in the United States.

In the past decade, while your exploration activity has been increasing by almost 50 per cent, wildcatting in the United States has declined by one-third. One good reason for this can be found in the fact that your finding, developing and producing costs have been 95 cents a barrel against \$1.70 a barrel in the United States. Another indicator is the fact that reserves per exploratory well in the United States in the same period have been around 465,000 barrels whereas they have been some 910,000 barrels per well in western Canada, and almost 1.4 million barrels per well in Alberta.

These differences constitute outstanding incentives commensurate with the risks involved in exploring in Canada and will surely result in more exploration in this great land.

You are in the happy days of pioneering in oil exploration. You also have good demand for your products, increasing production, growing exports, relatively low financing costs, and nothing to look forward to but for things to get better. This is why there are more and more American oil men coming to Canada.

Americans, as a whole, are thankful you are so close to us. Not only are you good neighbors as individuals, and as a government, but we

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hope you will be able to help us meet in the future, the tremendous growing demand for both oil and gas in the United States.

My last remark might cause some eyebrow-raising among you. You're probably now saying to yourself "That's poppycock! The United States restricts our exports of petroleum, and, anyway, there are sufficient reserves in the United States to meet its own needs."

Now, I agree that there *are* sufficient reserves in the United States to meet our own needs, but, unfortunately, we haven't been finding those reserves which still remain undiscovered. And, if we don't start finding them real soon, we will be dependent on "some" country or countries to supply our deficiency. Personally, I would rather see Canada as a major supplier because I don't think we have to worry where Canada will stand in an emergency.

This sad state of affairs has not been brought on by lack of undiscovered oil in the ground — it is the result of a drastic decline in the industry's effort to locate undiscovered oil in the United States.

The petroleum industry, in any country, becomes great because of a continuous and vigorous exploratory effort. This effort, always beset with great risks, is substantiated because the incentives to find oil and gas overshadowed the risks.

In recent years, and still today, government regulations and price inadequacies have served to lessen incentives while risks inherent in exploration have continuously increased. In addition, obvious geologic structures simply don't exist anymore. Drilling depths and costs are greater. The United States domestic exploratory effort is now approximately 35 per cent below the 1956 rate. The drilling decline which recently reached a 23-year low, sinks lower each month.

Of all activities engaged in by the petroleum industry, the exploration for new reserves of oil and gas is the most required, essential and necessary to its welfare and future. The petroleum and associated industries would disappear if new discoveries of oil and gas reserves did not keep pace with the expanding consumption of petroleum. While in Canada the reverse is true, reserve discoveries in the United States are not keeping pace with the consumption of petroleum products.

Were it not for the recent discoveries in the tidelands and offshore areas, we might, today, be seriously dependent on foreign sources for our petroleum needs. Even with tideland and offshore exploration, it is apparent that in the United States we are barely holding our own in the discovery of new oil and gas reserves. The fact is that even with your present good outlook, our continent could be facing a very serious petroleum crisis within 10 years—not 20 - 50 - or 100 years from now, but just right around the corner.

The more than 39 million barrels of liquid reserves in the United States are "piddling" compared to those in foreign lands. For example, in Kuwait, just slightly larger than the State of Rhode Island, there is one

field which has more oil reserves than those known to exist in the entire United States.

The search for petroleum is full of risks and high costs which are continuously spiralling upward—contrary to all sound, economic reasoning, crude prices remain where they have been for 12 years.

Naturally, with such an imbalance in economics—that is, a steady price for crude while the costs of materials, labor and other items have been going continuously upwards, and risks and investments have increased with deepened drilling — exploration activity has decreased considerably. Throughout industry's history in the United States, it has been established that exploration follows the course of crude prices.

" In the next 10 years our industry will be required to find 55 billion barrels of oil and 300 trillion cubic feet of gas in the United States to simply maintain an adequate reserve position against increases in demand. Over the past 10 years, United States discoveries have averaged about 3 billion barrels of oil and 12 trillion cubic feet of gas annually, a discovery rate which is much below minimum requirements for the future. Now we must double oil discoveries and triple gas discoveries.

Under existing conditions of high costs and risks and low prices for oil and gas, meeting the necessary exploration goals for the next 10 years is a challenge of the greatest magnitude.

If we are to meet the requirements for only the next 10 years, we will have to drill, in the United States alone, 25,000 wildcats per year and that means that the geologists and the geophysicists will have to find 25,000 good, meritorious drilling prospects each year during this period of time.

It is evident that we cannot possibly find these prospects and the required new reserves by employing present exploration philosophy and methods. So, what must be do?

Now, from here on, what I say is not limited to the United States but is applicable to world-wide exploration and to all petroleum explorationists everywhere in the world, regardless of affiliation or country.

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So, what must we do as explorationists to find the needed reserves of the future?

New exploration ideas are vitally needed. We must develop, as soon as possible, a new era of exploration.

The geologists and the geophysicists, together, must develop the new ideas. The new ideas will develop new prospects. This kind of leadership will bring about more wildcat drilling than ever before—provided there are the incentives.

New ideas and new incentives—these are the two ingredients for successful exploration in the future. The *incentives* are tied into less, and

more intelligent government controls, and more realistic prices for petroleum products, and the new exploration *ideas* and *concepts* are tied into us—the explorers!

At the present time, the odds against successful wildcatting for petroleum have increased to the point that they have become staggering.

An operator cannot depend on “lady luck” to find his oil or drill a well “by the seat of his pants” anymore. Every means must be employed to reduce the odds and risks inherent in petroleum exploration. This calls for concentrated study of all available information on a more coordinated and knowledgeable basis.

Management has pitted the geologist and the geophysicist against each other too long. Neither the geologist nor the geophysicist should permit this anymore. They should try to persuade and convince management to either coordinate their efforts or suffer the consequences of finding less and less reserves. The geologist and geophysicist can and must work together; management should not only encourage but should force this alliance.

When geologists first began to practice the art of finding oil and gas, they had little difficulty in locating places to drill. Anticlines, major fault systems, and even buried salt domes were easy to work out and map, because of the many outcrops and surface indications which existed.

But gradually what could be seen on the surface became less and less obvious and the geologist had a hard time finding anything to recommend for drilling.

Then, when a real breakthrough was needed, geophysics came along. Geophysics could work below the surface—beyond the limit of the geologist—and the industry embraced this new exploration method with open arms.

The geologist played a secondary role to geophysics and has been playing a secondary role for a long time—in fact, because geophysics has been doing the thinking for him, the cranial substance of the geologist has been under constant sedation for over 35 years.

Now, the cycle has turned a complete revolution. The geophysicist cannot find the structural traps anymore, or, let me say that geophysical structural anomalies are getting harder and harder to find where extensive geophysical exploration has been conducted. The geophysicist — like the geologist before him — has thoroughly combed the explored petroleum provinces — and very little remains to be found by the methods now in use.

The big reserves of the future lie in the less obvious traps — such as stratigraphic, which geophysics so far can't identify. Finding these elusive traps *will* require creative, highly imaginative thinking combined with using the tools of every applicable scientific discipline engaged in the search for new petroleum reserves.

The geophysicists' black electronic boxes, computers, and new chart mechanisms are tremendous aids in developing some of the scientific facts needed for finding these subtle traps. But these instruments should be a supplement to geologic thinking and certainly *not* supplant it, as was permitted for the past three decades.

This is not a condemnation of geologists or geophysicists, but of *management* for not coordinating their separate skills early — and waiting until famine is upon us to realize the need.

The successful oil finder of the future will be the explorationist who *thinks* — and one who is dedicated to the proposition that he must use his intensive reasoning powers of imagination, and must use the very best ideas and tools from others in order to get optimum value from the available knowledge.

When this happens we will be practicing the art of finding oil and gas as *true* scientists — as pure, thoroughly trained, well-rounded petroleum explorers — and not as unilateral specialists limited in scope, in knowledge and thinking power.

To be pure scientists we must rely on the basic fundamentals requisite for sound exploration which can be summed up in one word—*ingenuity*! The synonymus of *ingenuity* would cover several pages. In order for you to grasp the full connotation of the word, I will cite a few:—*inventive talent, keen perception, skill, resourcefulness, sharpness, ability, readiness, acuteness, capacity, aptitude, intelligence, inspiration, felicity, cleverness, aptness, proficiency, competence, attainment, accomplishment, adroitness, expertness, dexterity, efficiency, mastery, excellence and genius.*

Now, I will sum up all of these various meanings into still one other word — *creativity*!

Lately, we have been told of the necessity of "creative thinking" by other speakers, but I want to emphasize it in a different approach.

The one factor which makes the difference between a *masterpiece* and a *good* painting, in spite of the fact that two artists have the same background and technique, is *ingenious creativity*. Both artists have created, but the masterpiece has something extra—a little more effort and a sense of perception, and the artist had a *feeling* for the subject that the other did not have.

Basically, geology is an inexact science. That is why, in a sense, a good exploration geologist has to be an artist—working with knowns and unknowns—mixing together ideas and suppositions and facts. And this is why geology is so fascinating:—the geologist works with nature's mysteries—trying to relate the present to the past, and the past to the present.

The geologists possibilities for creativity in ideas are limitless. Bound by no exact numbers or equations, he is in a position, like the artist, to

resolve ideas into practical masterpieces through creative thinking which wanders from the beaten path, and which tries the unusual or different approach to a problem.

When tied to good common sense and reasoning, this kind of creativity is the key to nature's secret hiding places for petroleum: to the future discoveries of the world's giant oil and gas reserves.

The geologist will be required to form new concepts relating to the practice of the *art* of finding oil, whether it be for new reserves in old, explored provinces or in basins or areas which are unexplored or inadequately explored. His geological deductions will have to be daring and imaginative, yet attuned to basic fundamentals of geology and economics.

Bold and progressive creative thinking, associated with strong courage, conviction and determination, will sell new ideas to a management which really wants to be shown.

Let's face it — the large, obvious surface and subsurface structures are known and probably have been tested in the more explored countries of the world. Also, we know that many sedimentary relationships favourable to the entrapment of petroleum in stratigraphic traps occur in practically all basins. We know that some of these traps contain large amounts of petroleum because huge stratigraphic-type fields already have been found.

We also know that some stratigraphic traps do not contain hydrocarbons. But we cannot get away from the feeling that great quantities of *undiscovered* petroleum occur in strat traps throughout the world — and especially in the United States and Canada.

I'm sure that every geologist in this room, and perhaps some geophysicists, has a pet area which is a strat prospect but has done nothing about it because his company or his client only wants a structure to drill.

The explorationist will have to convince management that there are large fields to be found in the subtly hidden traps which defy any semblance of structure — the kind that will require "the sticking out of the neck" to find — the kind that's lying right under our noses.

Man forever is prone to follow patterns established by precedent, however antiquated. That is probably the reason exploration in a province always begins with probes of *structural* anomalies and continues enthusiastically as long as they are found — irrespective if any are productive. The influence of the fundamental anticlinal theory of accumulation still prevails, even in areas where the search for *stratigraphic accumulations* might be more successful than the drilling of giant structures.

An example of this influence is the promising Cook Inlet basin of south-central Alaska. During the past ten years there have been five major oil discoveries and eleven gas discoveries which were drilled on separate and distinct structural anomalies. However, during the same

exploratory period, fifteen barren anticlines were drilled in the basin. The barren structures all have demonstrable closure, but were formed after hydrocarbon migration had taken place.

Based on the pattern of exploration in this area, it is reasonable to predict that all known anticlines or structural anomalies probably will be tested before a single stratigraphic prospect is deliberately drilled. Despite this, there is sufficient geologic information available to indicate that large stratigraphic accumulations are highly probable in the Cook Inlet basin.

Fortunately, the guide lines which govern exploration thinking and procedures more often than not have unanticipated results. Were this not true, many of the world's great stratigraphic fields would not have been discovered.

Admittedly, it is more difficult to sell management supervisors on the merits of drilling a 100 per cent stratigraphic prospect than to sell them on a mediocre structural prospect; yet, paradoxically, we, as scientists, recognize that hydrocarbons commonly are indigenous to the sediments in which accumulation occurs and that many of the world's oil and gas fields are, in part at least, stratigraphically controlled.

Unlike discoveries on known anticlines, diapirs, or fault-controlled structures, most of the stratigraphic trap fields were discovered either by accident or by geologic reasoning that turned out to be incorrect.

For example, the legendary oil pioneer, Columbus M. "Dad" Joiner, promoted the drilling of a test well in Texas in 1930 on what he called the "Overton Anticline," a nondescript topographic high which had no sub-surface expression whatsoever and which was created in the mind of Joiner, who can be termed a promoter. Regardless of Joiner's geologic reasoning which was correctly "hooted" and derided by the best scientific minds of the day, he discovered the East Texas field, a stratigraphic trap, and the largest oil field in the Western Hemisphere. This area, by the way, was condemned by every geologist and geophysicist who worked it before Joiner.

It is obvious that the search for purely stratigraphic traps usually does not begin until late in the exploration history of a basin, after a great amount of geological and geophysical information has been collected and assimilated. This is the normal procedure before exploration for stratigraphic traps begins and generally this procedure is followed in most basins.

However, creative, bold thinking on the part of geologists and geophysicists, combined with an aggressive search for sedimentary traps will do much to get wells budgeted for stratigraphic exploration *much earlier* in the exploration and development history of a basin than has been the case in the past.

Management, whether independent or major, must be receptive to and encourage new exploration ideas. It should give its support to the exploration team in the application of new approaches to the exploratory effort.

Management should realize that it will require creativity and boldness—a high degree of imaginative deduction and an unyielding courage of conviction on the part of the explorationist—to find the big, unobtrusive fields in the future.

It should be certain that the policies and philosophies of exploration which management directs does not discourage creativity in ideas or dampen the willingness of an explorer to “stick out his neck” in support of his ideas for fear of getting it cut off.

So, in Canada, you are still in the pioneering stage of exploration. Your future as a petroleum producer and supplier is unlimited. But, don't get in a rut in your exploration methods. Don't just hunt for the structural anomalies. You should become oriented toward the less obvious and subtle traps and drill them as you think them out. Don't wait until all the structural anomalies are drilled to start looking for the strat prospects.

This procedure will prevent Canada from getting into the same situation the United States now finds itself. In the United States, we have practically run out of onshore structures. We've got to start finding the undiscovered accumulations in the strat traps to maintain an adequate future reserve-consumption ratio. Had we been thinking of these types of accumulations during the feast of plenty of the era of structures, we would have found much more reserves and be much better off.

You can find these strat accumulations by purposely looking for them as true scientists: by the use of sheer brain power.

One of the pioneers of modern petroleum geology, Wallace Pratt, once said that “oil fields are found in the minds of men.” So, if you want to find a new stratigraphic oil and gas field, look into your own mind. It is there if you know how and have the courage to use it.

Therefore, the new era of exploration will require the explorationist to convince himself first and then the wildcatter that a new, different exploration approach is the key to the discovery of the vast accumulations of oil and gas which occur within our reach.

Our future petroleum reserves will be found by well-rounded exploration teams composed of geologists, geophysicists, paleontologists, petroleum engineers, chemists, scouts, and landmen. They will use every known tool whether it be surface or subsurface mapping, computers, electronic boxes, field work, the laboratory, or whatever else is necessary and available.

Such teams will be led by the most enlightened, intelligent, and resourceful members. I should hope and expect that each of you will qualify.

But you cannot be the captain unless you can lead. And you cannot lead unless you can think. Your thinking must be sound, but bold. You must be creative in the fullest meaning of the word. You cannot simply be a painter. You must be an accomplished artist. Your work cannot be an exercise in mediocrity. It must be a masterpiece!