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Thoughts and Comments on the Future of the Geologist

by H. H. Suter, Calgary[1])

In his article on the prospects of the North Sea (Bull. S.P.G. v. 31, no. 80, p. 46) D. Rigassi ends with some, as he implies, hair raising vistas on the future of the geologist. He says, in effect: unless the geologists become seismologists or engineers they are doomed to an early species death.

A fine outlook for the new year and especially so for the budding geologist. Not that Rigassi should not be entitled to make such a forecast, on the contrary his remarks are welcomed as very timely, if somewhat gloomy. Indeed it seems the time has come for a general stock taking of the present image of geology and of the future of academic, governmental and industrial geologists. An inquiry would be indicated even if it only resulted in a back slapping ceremony, which it decidedly will not. A stock taking may open up in form of a discourse. It is hoped that many including the young cand. geol. will take part in the discourse, for who likes to see his life's profession prematurely join the ranks of the silex hunter of yonder years. It is hoped that out of the discussion will come a geologic Thesaurus and that young and old will contribute to it.

It does not really matter who opens up the discussion but a discussion is surely indicated and once started may spread its waves all over the globe. The quicker, the more, the better. The following conments and remarks are purely personal, neither reflecting Swiss, European nor American thought. What is in the mind of the geologists of the various curtains is another matter, we may yet hear from them in similar tones.

There is no hiding the fact, in some parts of the world – at least – there is a geological malaise. Geology, geologists and geologic schools have their ups and downs of an amplitude and frequency that indicate something is fundamentally wrong. It seems also obvious that the geologist himself is largely if not wholly to blame for the situation.

According to D. Rigassi there are about 30,000 active geologists looking for the needles in the various hay stacks. He does not say whether his estimate includes all geologists, regardless of speciality, in front or behind curtains. Let us accept this figure and assume it includes teachers and governmental geologists as well; it then means one geologist per less than 5000 km^2 of land surface from which to scratch a living and a satisfaction. Compared with other professions areawise, the competition for geologic working space seems moderate. But on this basis Switzerland (e. g.) would only be able to support some 8–10 geologists, yet it has many more at its disposal. Even this little comparison may show that the problems of the geologist and thus of geology present and future are specific and that they may and will differ vastly between countries and continents, not to speak of the oceans.

D. Rigassi hurls some specific accusations into the face of geologists. E. g. he questions their contribution to the solution of the genesis and life history of natural hydro-

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carbons. As a matter of fact the chemists floundered very badly for decades before Cox erected his famous geologic fence. Was his contribution not a material, fundamental one-despite the fact that the geologist Hollis Hedberg had to revise it recently?

One does not go far wrong when one categorically states that not a single geologic law, rule or tendency has been formulated by a pure physicist or chemist not even a geophysicist. And there are plenty of geologic laws, although nobody has yet tabulated and codified them all for everybody to consider and or use. The geologic approach to earth problems in opening and maintaining a dialogue with earth directly instead of talking to a «model» or to «models» however seductive, is not only satisfactory for body, soul and reason but also necessary and rewarding. It is necessary to bring the abstract geophysicist or geochemist (or should one say surrealist) back to earth from time to time. The geologist stands or falls with Antaeus the Greek, who not only lost his balance but his life when the geophysical Hercules lifted him up and threw him. Antaeus had lost his contact with earth. The lesson is clear: the geologist must not lose direct contact with earth ever. Thus, mapping is still his main task, his main preserve. In fact the statement: an earth scientist is not a geologist unless he has mapping experience, still stands. Of course, some of this mapping may be under the microscope but must be based on sampling in the light of actual geologic conditions. Mapping is exploring, exploring is satisfying curiosity and curiosity is the beginning of science. So mapping is not only an activity satisfying human senses and desires but it is the basic step toward understanding. A step to which there is no short cut.

There is a tendency to belittle any «science» that does not use higher mathematics. This is not only a superficial, naive attitude but one detrimental to progress and achievement. Mathematics is only the alphabet, the script of science, not even its sole language. The creative mathematician «fiddles» with a problem, looking at it from all sides exactly as a violin maker looks at a knotty piece of wood, not being sure what to make of it, whether it should become an instrument or be relegated to the furnace. In his decision experience, imagination help him to see solutions and in selecting tools. The different grades of mathematics are more or less equivalents of the various modes and scripts of writing. The pedestrian laboriously writes his message in longhand, the somewhat more impatient one uses the typewriter, the most sophisticated one uses the shorthand typewriter. All work with symbols. These may differ but relationships between them remain universal. The fact that I know the alphabet does not mean that I can write immortal sentences or new equations but I can write good messages in longhand even if shorthand is beyond me. Talent enters and mapping requires talent as much as mathematics does, only talent of a different sort. Who is qualified to set values? A somewhat similar situation obtains in mathematics to a certain degree. Lower mathematics can solve many problems although at slower speed and less elegantly than higher math. can. It is often said that even higher mathematics or even the computer cannot solve all geologic problems because factors are too numerous or cannot be measured. In many cases the geophysicist extrapolates (because he has no other choice) beyond the range of a particular law. He makes a guess at the probable nature of the extrapolation curve, whether rightly or wrongly he does not know. He is completely out on a limb and quantitatively so. His deductions from this extrapolation (even if checking against other extrapolations) are then purely qualitative and have no more validity than any geologic speculation based on non-symbolic, i. e. commonsense philosophy. However there is an immensity of as yet unsolved geologic problems (many arising out of mapping) that can be solved or brought closer to a solution by the use of simple mathematics. Graphical solutions, ratios x/y diagrams may suggest themselves, tabulations simple statistics may do to put the data into a more abstract form to serve as basis for deduction and for formulation

of relationships. In some cases mathematical geology has become an end in itself and the reader is left to work out his own application. What is a mathematical petrographer driving at when he ends up his conclusions by saying, the sand grains show a gaussian distribution? Obviously to be of some practical use this statement must be translated into geologic language. If the mathematician is unwilling or unable to make this translation then the geologist must re-enter. Instead of throwing geology out in favor of a geophysics obsessed by models, it might be worth training ourselves in the habit of thinking in modest mathematical terms and in the possibilities of tabulations before taking a further step.

The geologic contribution to science, philosophy and to the ecology of mankind in general in the past entitles us geologists to a hearing but not to sitting back. D. Rigassi is right when he suggests that geologists should think of making a new contribution to mankind and when he hinted that they should now be in a position to predict (prediction being the acme of scientific achievement). He further suggested that we should take an active hand in shaping and maintaining man's habitat. As regards forecasting quakes this has to be left to the seismologists, the geologists, however, can forecast and outline danger areas, earth slip areas etc. and can suggest remedial action or protective measures. On the other hand D. Rigassi seems a little premature in believing that the era of use of fossil fuels will shortly end, and that water management will rely in the near future on the conversion of seawater to freshwater and that oceans will supply all the metals needed. In short, that the romantic period of geologic exploration is about over. He may be right in suggesting that the horizon of the peripatetic exploration geologist is closing in. Geologists will continue to be in demand but the plurality of them will be pedestrian, tied to the country of their origin with exception of a few «chosen» ones able to roam in the service of global organisations. This trend is being speeded up by the ill adviced efforts of some such organisations as the Peace Corps who not only throw geologists out of their legitimate work sphere but lower the standard of living of many others. Technologic replacement of natural resources such as those mentioned above will not be so soon in coming. This is so for various reasons all of which make it certain that classic natural resources will continue to be used generations hence. For one thing, national and international politics enters and there will compulsive reasons not to give in to promotors and burocrats so quickly. Oceanic water will be used to supplement meteoric water and ores will be dug out of the earth at depth unheard of at present.

What does this all mean for the future of geology and of the geologist? It means in first line, the future geologist will find it increasingly more difficult if not impossible to find worldwide nor even continentalwide experience so necessary for his maturation. This creates an urgent need for making this experience available to him in some other form. There is a real need now for efforts such as listed below:

1. To tabulate stratigraphic, petrographic, paleontologic and structural data on a global scale, to process it chronologically and chorologically, statistically and graphically.

2. To process available basic geologic data on a global scale into maps of various types and scales instead of looking for more detail. It is admitted efforts are under way but compared with those spent on the geophysical year they are puny, inadequate and not appreciated anyhow.

3. To tabulate, assemble whatever dynamic tectonic data we have – again chronologically and chorologically – maps, graphs etc. worldwide.

These three items may involve supplementary surveys but they could become the geologic fence that geophysicists must hurdle. With such an assembly, such marshalling of ready available facts at hand the geophysical tectonician and the mathematical geo-

logist would have some real working material and would no more be able to get away with such sweeping statements on global problems (e. g. Continental drift) as they manifestly do make occasionally and who is to blame but the geologist.

4. There is a need for a global inventory of natural resources including those of oceans.

5. The time may have come to establish an earth quake warning system on a global scale and issue maps of quake zones etc. etc.

6. A start should be made with the production of geotechnical maps of all sorts showing the land in geotechnical that is engineering geologic terms.

7. Finally one of the greatest needs is a series of handbooks of comparative regional geology. Not only on the grounds of know thy neighbor but for every day utility.

Above suggestions are only a few that can be made and will be made once a group of geologists gets together to compose a catalogue of desiderata. It is obvious there is plenty scope and work and sense making work ahead for all groups of geologists, academic, governmental, industrial. Geologists are not yet fully alive to the fact that after a hundred years of fact gathering it is about time to sort the plunder and process it into something that can serve as a footing for the pyramid of sciences.

All above requires international cooperation and cries for the creation and activation of a truly geologic decade. Who will start the «globe» rolling, the sooner the better!

Geology today, seems to be in a similar position as geography was in the early decades of the 20th Century. Geography had split up into many little fields, each pretending to represent the heart and soul of geography. Other sciences (Geology among them) had begun to gobble up entire lumps of the body geographic. Books were written, meetings were held. What happened since I do not exactly know but today one finds more active geographers than probably ever before. It can do no harm but only good for geology to examine its image, its content, philosophy, limits and possibilities. One may say at present there are still too many geologic «Schools» but too few geologic «Universities». This is in a way natural because so much in geology is based on an individual's mode of seeing and it requires a conscious effort to translate a geologic impression or observation into a scientific fact, a fact verifiable by repetition of an observation or by consultation of an acceptable document like the documents of history. Geology is science but a science with a very strong historic aspect. In fact Geology is History too with all the implication that this term connotes.

Recent attempts at renewing an interest in the philosophy of Geology are as yet only scratching the surface, being far too apologetic and not enough analytic. It is hoped that an international body will take this subject up in earnest and come forth with some fundamental insights.

There is a real need to impress upon editors of popular scientific periodicals the fact that geophysicists are not exactly the ordained spokesmen for geology nor global geologic problems. Geophysicists right now have a clarion voice but they can often be thankful that the hearer or reader has – on average – such a short memory.

This brings up a real complaint, namely the one about the wordiness of the geologist. None of us is free of this habit. Does it arise out of the nature of geology, or is it an acquired one or is it possibly inculcated by our dear professors? Whatever the answer may be, whether our memory is of the motor, optic or acoustic type we may gain from cutting down on description, relegate it to tabulations and comments thereof. Here the physicists have a better habit, they separate recital of facts from interpretation thereby avoid mixing them. There are still too many geologic papers with good maps, graphs and tables repeating in the text almost everthing that can be read from the enclosures or figures at much greater speed and with much greater clarity. Let the enclosures speak for themselves point out conclusions, let the reader find the evidence, cease spoon feed-

ing him. One way to avoid lengthy descriptions is to stress comparisons. This maxim applies to all types of geologic topics whether local or regional in scope. The type section concept – now so fundamental and functional in stratigraphy – has not yet penetrated into the realm of historical or regional geology and hardly into that of structural geology. The concept is still largely two dimensional (not even areal). The time has come to adopt the «type» idea into all branches of geology and especially into that of regional geology. The results will be revealing and stimulating and will give us that solid background against which to check tectonophysical speculations. Truly comparative geology should be our next goal and it may give us the impetus needeed to ascertain for geology its place in the foreseeable future.