PERTEMUAN PERSATUAN
Meetings of the Society

Ceramah Teknik (Technical Talk)

Needed new technologies for the 21st Century: new systems for sustainable development, urban, and rural

W.S. FYFE

Laporan (Report)

Prof. Fyfe, who is currently the external examiner at the Geology Department, University of Malaya, gave an informative talk on 30th July 1999 at 5.00 pm at the Geology Department, University of Malaya.

Abstrak (Abstract)

As we move to the 21st Century, we face a new world demography, a world population of at least 10 billion, with Europe and North American 10–12% of world population. Many of our present systems must change (urban planning, energy, transport, food production, waste management, use of materials for construction). There are great opportunities for sciences and engineering. Examples include those from Europe, North America, Brazil, China, and India. We can solve most of the future problems but we require new systems, TEAMS of experts, who can work together with economists and planners. ECO-logy, ECO-nomy, are not in conflict! Our fundamental life support systems include:

- Climate
- Air to breath
- Water to drink and for agriculture
- Soil of quality for food production
- Transport technologies
- Materials of all types derived from the Earth (fertilizers, wood, steel, concrete .....)
- The careful management of wastes of all types
- Energy, which at present is 90%, derived from oil, gas, coal
- Biodiversity

Almost all of these basic components of our life support systems are being seriously changed in ways, which could change the total ecology of our planet. Air quality is deteriorating in most of our giant urban complexes. Water quantity and quality is a growing concern in many nations. But perhaps most of all we are changing the climate, temperature, rainfall distribution, winds, by additions of various gases to our atmosphere. Many of our present technologies could lead to our destruction!

Can we produce the necessary sustainable technologies? The answer is yes! But we must develop new systems, new TEAMS of experts to address the critical problems. And these teams must include experts from sociology and economics, and such people must consider the long term impacts of development.

Specific examples discussed include:

- Removal of toxic elements from water
- Nuclear waste isolation

Warta Geologi (Newsletter of the Geological Society of Malaysia), Vol. 25, No. 4, July-August 1999

- Combustion gas disposal
- Soil remediation using wastes and minerals
- Soil erosion reduction
- Clean mining using microorganisms
- And, solar energy, light, wind, waves

For all such problems, knowledge for the Earth Sciences is at the foundation of the development of truly sustainable systems. All people on this planet must be educated to understand and respect their support systems, universal literacy, numeracy and sciency. Quality education is the key to survival and quality of life. We must respect our planet and biodiversity.

Every human uses several tons of rocks and minerals every year for the diverse needs of modern society. Such uses include those for construction, metals, fertilizers and energy. All our resources, and many of our waste disposal systems involve the manipulation of rocks and minerals of the outer few km of our planet.

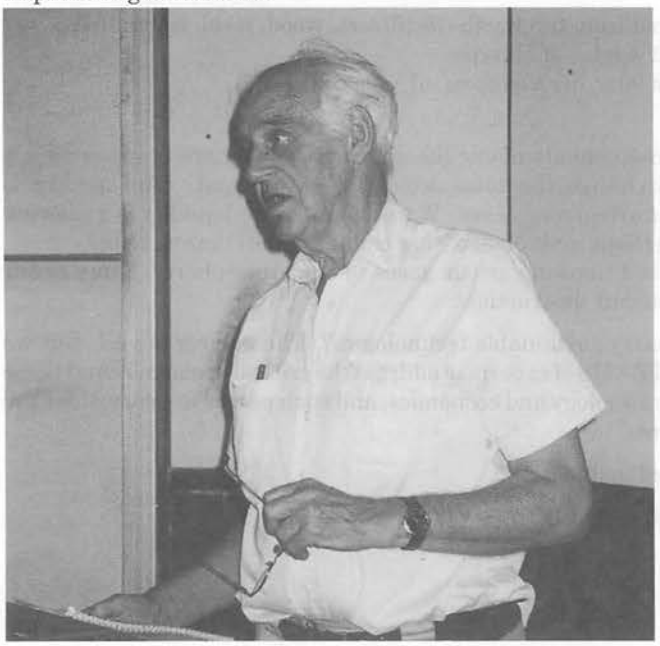
Recently, 1993, the former editor of Science, Koshland, wrote:

"First of all, it is important to identify the main villain as overpopulation. In the good old days (viewed through the myopia of nostalgia), the water, air, flora and fauna existed in an idyllic utopia. But, in truth, there were famine, starvation, horses and buggies that contributed to pollution, fireplaces that spewed forth soot from burning soft coal, and water contaminated with microorganism. The humans were so few, and the land so vast, that these insults to nature could be absorbed without serious consequence. That is no longer true."

We have been careless. First we have neglected quality control with many materials used on a large scale. Examples include the minor elements in coal (such as halogens, arsenic, uranium and many others), the minor elements in phosphate fertilizers, even the impurities in construction materials. Recent studies show vast areas of polluted soils with elements like arsenic, cadmium, lead.

We must improve our technologies and quality control of raw materials (all elements). The recent discoveries of microorganisms which exist to depths of over 4 km suggest exciting new opportunities for metal extraction. We could mine metals like copper and zinc in their sulphide ores using bacteria and avoid huge disturbance of land. Recent work in New Zealand has shown that certain trees can be used to concentrate gold from low-grade ores.

A growing world problem involves the deterioration of soil quality, soil erosion. We must learn to prevent erosion and to remineralize soil. During a recent visit to Japan I was impressed by the positive influences on soil fertility of volcanic ash. In Portugal we have shown that the sediments accumulated in dams and reservoirs can be very effective soil additives. Work in India and Canada has shown that with quality control, coal ash can greatly improve degraded soils.



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The careful disposal or long term isolation of toxic waste products is a growing world problem. Over the next decades the world will spend many billions of dollars on nuclear waste isolation. Where are the best places on Earth to isolate such wastes? Where do we have massive rock volumes with very low permeability or time scales of millions of years? Which are the best rocks for absorbing toxic elements? Recently we have shown that certain types of basalts are excellent for the underground disposal of combustion gases and acid rain components. The processes are mediated by deep bacteria.

We can improve our technologies for the use of minerals and for the reduction of wastes. We need new economics which consider the long-term impacts of mineral use and the recycling of mineral products. It is also clear from recent work that there are vast metal resources on or near the seafloor, an international resource.

And, when advanced nations use the mineral resources of developing nations, the environmental laws which apply at home, must also apply in all foreign operations.

Malam Sains Tanah/Soil Science Night — Report

Tuesday, 10th August, 1999
Geology Department, University of Malaya

The above event was attended by about 30 members. Three prominent Soil Scientists, namely Prof. Shamshuddin (UPM), Sdr. Ghulam (MARDI) and Dr. Paramananthan (Consultant) presented interesting talks covering various aspects of soil science. It is interesting to note that geologists working in soil science not only have to deal with rocks and minerals, soil chemistry, but also a host of biological "components" such as worm casts, groundnuts, corns, etc. It is also interesting to note that in soil science, soil depths of > 150 cm (1.5 m) are considered very deep! — recall engineering soils?

A very lively Q&A session followed the three presentations.

The abstracts of the three papers presented for the Malam is enclosed below.

Footnote: Prof. Shamshuddin has kindly left behind reprints of the following papers (now lodged at Klompe) for members' reading pleasure:

i) Shamshuddin, J. and Ismail, H., 1995. Reactions of ground magnesium limestone and gypsum in soils with variable-charge minerals. Soil Science Soc. of America Jour., vol. 59, no. 1, Jan-Feb 1995, 106–112.

ii) Shamshuddin, J., Syed Omar, S.R. and Sharifuddin, H.A.H., 1997. Alleviating soil acidity in highly weathered tropical soils by limestone and gypsum applications. Trends in Soil Science, vol. 2 (1997), 205–215.

iii) Shamshuddin, J., Sharifuddin, H.A.H. and Bell, L.C., 1998. Longevity of ground magnesium limestone applied to an ultisol. Commun. Soil Sci. Plant Anal., 29(9 & 10), 1299–1313 (1998).

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