The poor geographic distribution, that is, the localized concentration of uranium ores is worth noting. The conglomerate ores occur in an area of less than 200 square miles in Canada and in a single structural basin in South Africa. The sandstone ores are similarly concentrated. More than 90 per cent of the U.S. reserves, which is equal to two thirds of the world's sandstone reserves, are found at Grants, New Mexico and in Central Wyoming. Half of the ores in "veins and other deposits" are found in South West Africa, France, and Australia.

The example of the minimum economic ore deposit might be continued to consider its fuel value and cost. At a (rounded) requirement factor of four tons of U_3O_8 per 1000 MW(e), the 2000 tons would fuel a 500 MW(e) plant for its 30-year life. In the United States, for example, 2000 tons of yellow cake could be found and produced under favourable circumstances at an average cost of around $20 to $30 million, but those costs are relatively low because the mines and mills are several times larger than the minima considered here. Today's cost of 200 tons of yellow cake in the world market would be about $25 million or more. The cost differential between buying yellow cake and producing it depends largely upon successful exploration and efficient exploitation.

If a minimum uranium district is defined as a center of uranium mineralization with 2000 tons or more of U_3O_8, then only about 40 such localities can be counted in the countries listed by the NEA/IAEA Working Party on Uranium Reserves[1]. It is interesting to note that those districts, and a few others, represent the successful outcome from among hundreds of projects where exploitable quantities of uranium were not found, and from among many thousands of examinations that were not sufficiently favourable to justify recommendations for physical exploration. Only one in several thousand prospects that are examined, and a very low percentage of the physical exploration projects, will ever develop into exploitable ore deposits. In other words, most exploration fails!

Reference

1. Uranium Resources, Production and Demand, published by OECD, Paris; ISBN 92-64-11121-2.

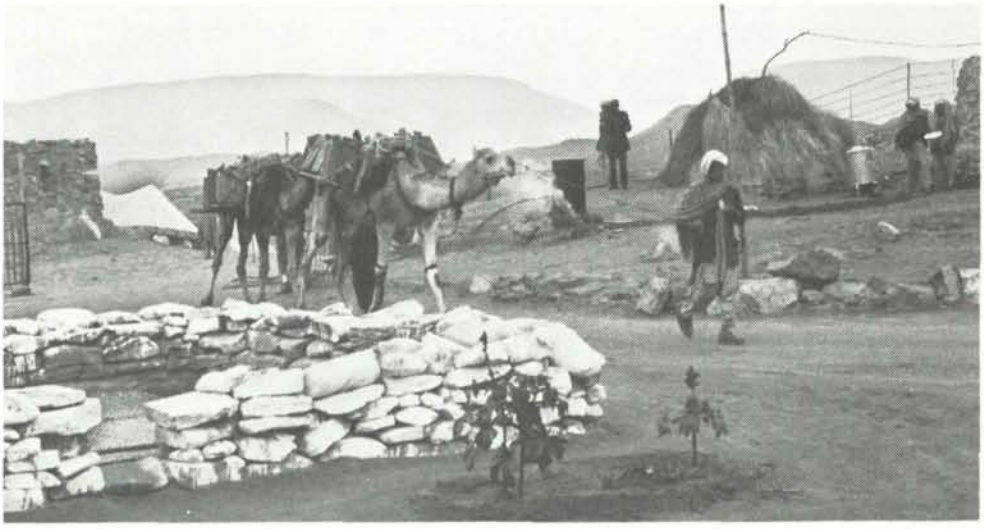
"In the Field"- in the Himalayan Foothills

by Paul Fent, recently returned from Pakistan

Accidentally, somebody had failed to switch off the Geiger counter; accidentally, somebody glanced at it. That is how Pakistani geologists returning from a routine survey along a mountain track discovered "radioactive anomalies" – that was all that could be said at the time – in the foothills of the Suleiman Range which belongs to the western part of the Himalayan arc. The presence of uranium was soon established.

Armed tribesmen turn up for work, exploring for uranium in the Suleiman Range area of Pakistan.

From October to April camels bring water to the uranium exploration base camp. During the hottest months the wells dry up and work ceases.



This happened a long time before the "energy crisis". In fact, the first uranium boom had just subsided; only easily exploitable deposits were of interest. So nothing much was done about it during the next decade. Three years ago, however, at the request of the Pakistan government, the IAEA, with the financial support of the United Nations Development Programme (UNDP), began systematic exploration.

Project headquarters were set up in the Atomic Minerals Centre at Lahore. From Lahore to the main base camp it takes an hour's flight southwest to Multan, and a six hours' drive westwards with a jeep, over the pontoon bridge of the Indus river, across sand and stony desert and through deep ravines up into the barren mountains.

This first base camp, a dozen tents and as many rush-covered, dome-shaped native huts, lies on a narrow ledge. And on the slope below, on the sides of fantastically winding gullies and on the face of shallow caves, the adits dug during the initial explorations, one can actually see the uranium: a greenish-yellowish line, about an inch wide, embedded in soft sandstone. The area is pitted with hundreds of markings where holes have been drilled to extract rock samples.

Working side by side with the IAEA/UNDP drilling and geology experts are a number of young Pakistanis who, in due course, are to take over the whole exploration project. In addition there is the main labour force of several hundred turbanned local tribesmen.

Somewhere on the way up to the base camp, one has crossed an invisible line, thinly drawn on Pakistani maps and marked "Tribal Area". Neither the British nor the Pakistani government have ever been able to establish full control over these tribesmen, who are Baluchis although this area lies well within the West Punjab and the Baluchistan border some thirty miles further to the west.

The tribesmen operate the drills, build the roads and bring up fuel, food and water on camel back. But only from October to April. During the remaining six months maximum temperatures of 122° F (50° C) are common; the "nalas" (in the Arab countries they call them "wadies") dry up; the tribesmen move down into the valleys and all work stops.

None of the experts is as yet prepared to commit himself and say how many tons of economically mineable uranium are present in this grey, rugged area which is approximately 120 miles long and 30 miles wide. The results of their explorations have, however, been so encouraging that the work is to be extended for another two years, when the present phase of the exploration project has expired on 31 August 1974, and that UNDP will contribute over $500,000 and Pakistan about one million dollars.

What substantial uranium deposits could mean to a developing country otherwise poor in untapped and economically exploitable energy resources like Pakistan can be imagined. Pakistan is one of the eight developing countries that have nuclear power reactors in operation and it plans to increase its capacity considerably in the future.

Whatever its final results, the IAEA/UNDP operated uranium exploration has already brought Pakistan considerable benefits. An almost inaccessible part of the country has been opened up. Some 34 miles of road were built where previously there had been camel tracks at best. Water was accidentally found in one place during drilling for uranium. More important still, the income of hundreds of extremely poor tribesmen – averaging $7.00 per month – have trebled. This does not simply mean more food, better clothing and a higher standard of living for all. By giving these people more economic independence, it might help the government with its efforts to break the power of the Sardars, the chieftains, and to replace their feudal system, the so-called "sardarism", by a more humane and democratic one.