from the viewpoint of waste containment.

A useful property of plastic clays is their potential capacity for self-sealing. With progressive compaction and burial this property will be lost but will be countered by an increase in thermal stability as a result of the expulsion on non-structurally held water. As these changes are mutually exclusive an intermediate compromise has generally been sought involving for instance selection of areas containing uncleaved mudstones.

Although salt domes occur beneath the UK Continental Shelf they appear to be absent beneath the land mass and the evaporite formations available are all bedded deposits. These generally occur within thicker argillaceous formations and are gybrid sequences containing interbedded evaporites and mudstones and/or siltstones.

The areas containing argillaceous and evaporite formations which have been selected provisionally for more detailed study are also shown in the figure and briefly described in the box.

It is hoped to mount studies to examine the feasibility of geological disposal to argillaceous rocks at sites in each of areas 8-11 and at one site within areas 12A-12C for preliminary studies on the hybrid evaporite/mudstone sequences. Work has not advanced as far as with the crystalline rock studies and at the present time no research sites have been identified and no applications for permission to drill boreholes have been submitted.

Conclusions

The feasibility of the disposal of high-level radioactive wastes within the geological framework of the United Kingdom still remains to be demonstrated. The immediate need is for comprehensive site-specific field data from a range of potentially appropriate geological environments both to test the criteria on which these environments were chosen and to provide a data base from which potential disposal sites may be identified. The feasibility studies suggested represent a major step towards these objectives and need to be initiated as a matter of urgency.

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Sun-soaked but blind to solar power

On the counters of the Caixa General de Depositos, the largest government bank in Portugal, bright orange folders decorated with a smiling Sun attract everyone's attention. They announce credit facilities for equipping private homes with solar water heaters. Up to £500 loans can be obtained at 10% interest over 10 years, an extraordinary bargain in a country where inflation reaches 50% a year and interest rates on short term deposits are 20%. "The response, however, has been minuscule" says a bank official. "There is no echo of interest in the public; people just don't know what it is."

The first installation financed by the Caixa was hastily inaugurated on June 23, a Saturday christened Sun Day, in a village 20 miles south of Lisbon. Here a successful architect has equipped his new country home with three solar panels in the garden. This 300 litre system cost £800. The installer, Mr Falconer, is a British subject and one of the two pioneers of solar energy installations in Portugal. He told *Nature* "the bank wanted publicity, but the house was still not finished at the time of the inauguration; so we connected a plastic hose to the plates to prove to the press that they heated the water." Falconer's firm has been importing MIROMIT plates — selective coating plates developed by the Tabor group — from Israel since 1961.

The other solar energy pioneer is Mr Neves da Silva, who obtained a Portuguese patent for a simple painted flat solar collector in the early 1960s. He is director of PRETEC, a mechanical construction firm, and he first attempted to build his collectors from national materials. "We tried to use cork, Portugal's main export product, as an insulator, but the price was too high; so we have to use glass wool like everyone else."

Both men are enthusiastic practical engineers. They have believed in solar energy for the past twenty years in spite of general indifference and incredulity. "In the sixties I had to deal with an engineer who stayed up all night hoping to catch me heating up the water in the reserve tank with an electric resistor. That was the only way he could imagine I could get hot water during the day from my system" recalls Mr Falconer.

"In the early days solar energy was no more than a toy for the very rich. Today it may still be mainly 'to show to the English', as the Portuguese saying goes." Indeed, a stone's throw from the casino in the resort town of Estoril on the fashionable Costa do Sol stands a huge mansion which is, according to its owner, the only solar equipped house and swimming pool in Portugal. Among the bougainvillea trees and parterres of geraniums are interspersed rows of solar collectors; the mansion itself displays several striking black overhangs on the south side. "My pool is heated up by 24 panels; my family has used it 90 days per year since 1961" says Virgilio Gomes Borges, one of the brothers of the Borges Brothers Bank. "I use 32 panels in the sanitary water circuit; additional heat storage is provided by the electrical company's reduced night rates."

Using the Sun's light remains an elitist activity haphazardly conducted in the midst of abundant talk about energy crisis on the one hand and Portugal's exceptionally favourable climatic situation on the other. Tourism officials claim 244 sunny days per year. A more objective but no less encouraging way of rating Portugal for its potential is through its atmospheric transmission ratio — of the energy received on a horizontal surface on the Earth to the energy received on an equal surface at the top of the atmosphere, averaged over a year. According to Dr Collares Pereira, the only Portuguese physicist with a PhD in solar energy work, that ratio varies between 0.3 for high latitude rainy climates and 0.7 for clear desert locations like Albuquerque in New Mexico. Lisbon's ratio is 0.65 (and the south of Portugal is considerably sunnier) while New York and New Jersey, at the same latitude, hardly reach 0.5.

The local capacity for building solar plates has improved over the years. Mr Neves da Silva remarks that back in 1962 he operated as "an artisan", but today PRETEC would be capable of producing 100 collectors per year. What is missing, however, are serious orders and some planning and stimulation on the part of the government. At the opening session of a Franco-Portuguese seminar on solar energy last March, Mr Sidonio Pais, General Director for Energy of the Ministry of Industry, declared that it was impossible for him to be specific about solar energy developments at the moment because "our government does not have yet an energy policy".

At the same seminar, the Secretary of State for Higher Education praised the ecological advantages of solar energy but spelled out no plans for the future.

In the private sector several religious schools have put up collectors to heat up sanitary water. "It is quite well adapted to the kind of financing that this type of institution can do" says Neves da Silva who built the systems, "religious groups can easily raise money once-off for such a project, and solar heating does not give rise to monthly costs afterwards."

For the future the Ministry of Health has in its files a construction program for 27 health centres throughout the country, each equipped with 75 solar panels for sanitary water heating. It should come up for bidding soon.

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