HYDROLOGY AND WATER SUPPLY OF THE MALTESE ISLANDS

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WATER supply is essential to all forms of economic activity, both the industrial and the agricultural. It is, therefore, not surprising that a great deal of attention has been paid to this topic in Malta where, as in all Mediterranean countries, rainfall is very unreliable, making water supply a perennial problem. The rapid growth of population (about 340,000), the high standard of living, and increasing tourism, all lead to an increase in water consumption.

The Climate

Malta has mild, wet winters and hot, dry summers. The average annual reainfall is about 508 mm. Temperatures very between an average of 6°C. in winter to 32°C. in summer. The average daily number of hours of sunshine is 5 in winter (December) and 13 in summer (July). (Fig. 1)

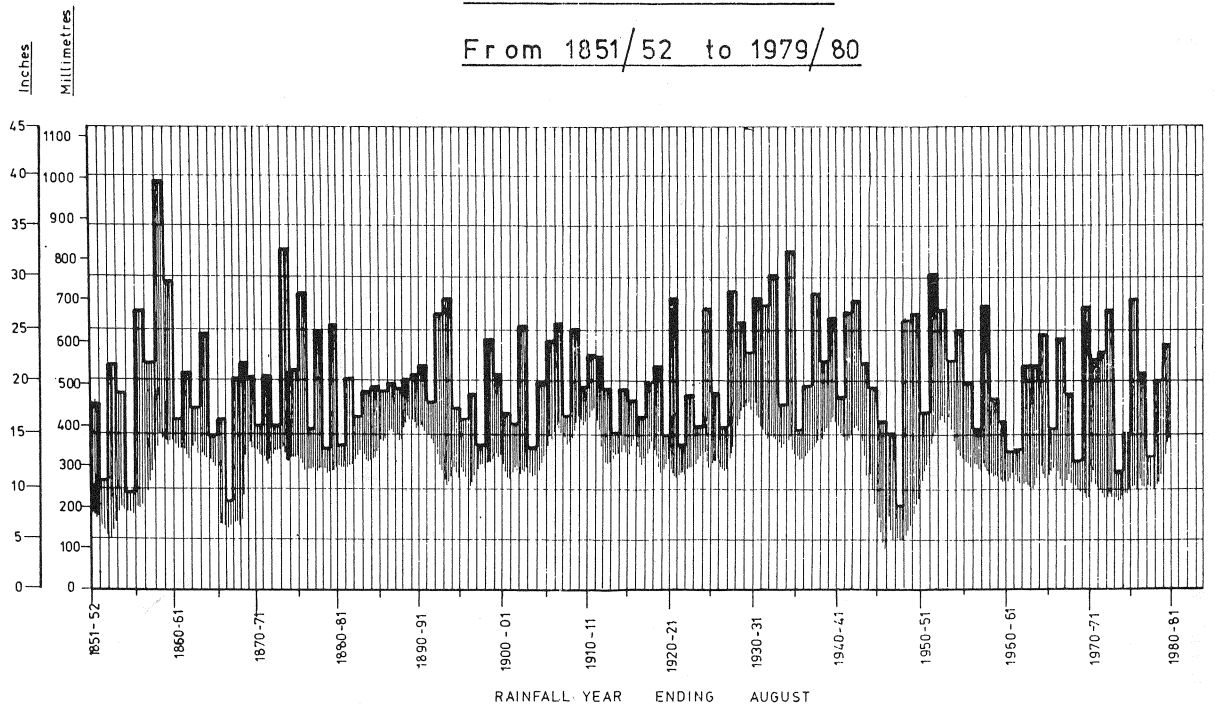
The heavy, often over-localized downpours (accompanied by rapid run-off) in which the bulk of the rainfall occurs, together with summer drought and intensive evaporation, are factors which greatly reduce the effectiveness of the not so abundant precipitation.

Geology

a) Stratigraphy

Malta is fortunate in its stratigraphy which provides favourable conditions for percolating and underground storage of rainwater. The Maltese archipelago is made up of sedimentary rocks formed in shallow waters during the Miocene – Oligocene periods (Tertiary Carbonates). Some Quaternary formations of rocks are also found in some areas. Our calcareous rocks are made up of plankton, fossils, and sediments which originated from land-derived materials. (Fig. 2 shows the layout of Maltese Geology)

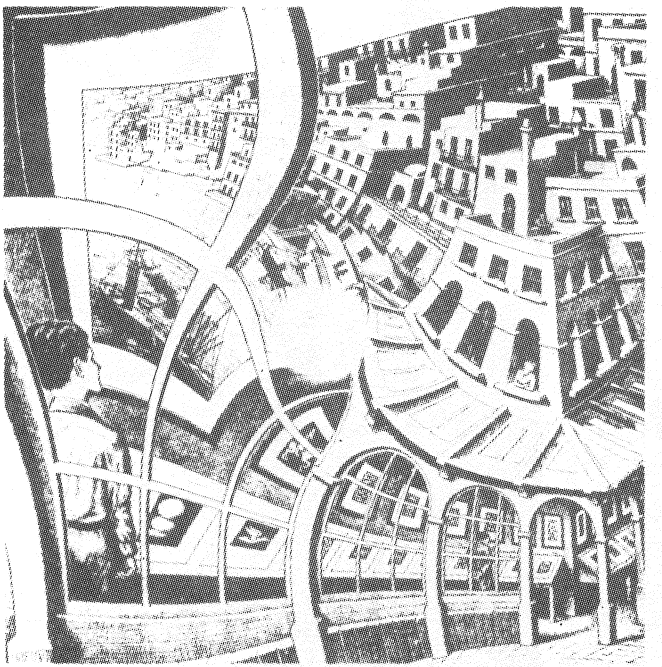
The most valuable aquifers are the Upper and Lower Coralline limestone. However, the presence of bedding planes, joints, and fissures is more important in controlling the underground movement of water than are the porosity and permeability of the rocks themselves. Globigerina is composed largely of thick and relatively impervious marly beds, through which percolation is slow and from which run-off is correspondingly rapid.



Rainfall has been recorded on the island since 1851 and the mean annual figure is 508mm. The replenishment of both acquifers depends directly on the annual precipitation.

Question 17.

(a)



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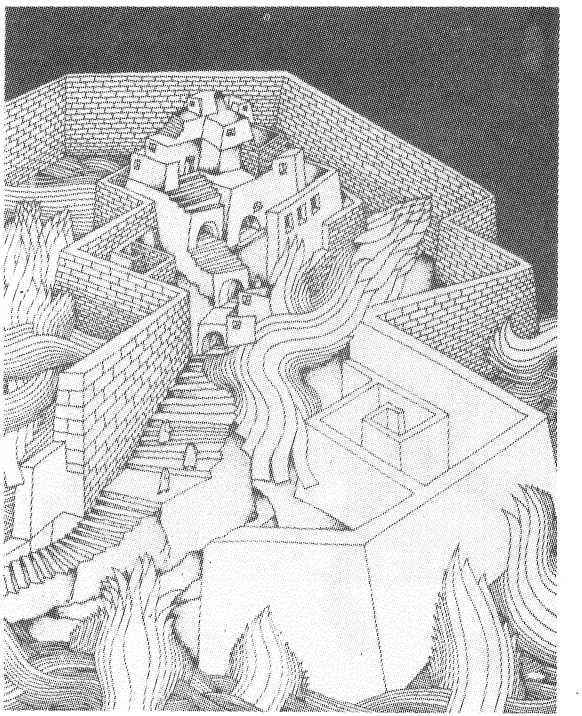

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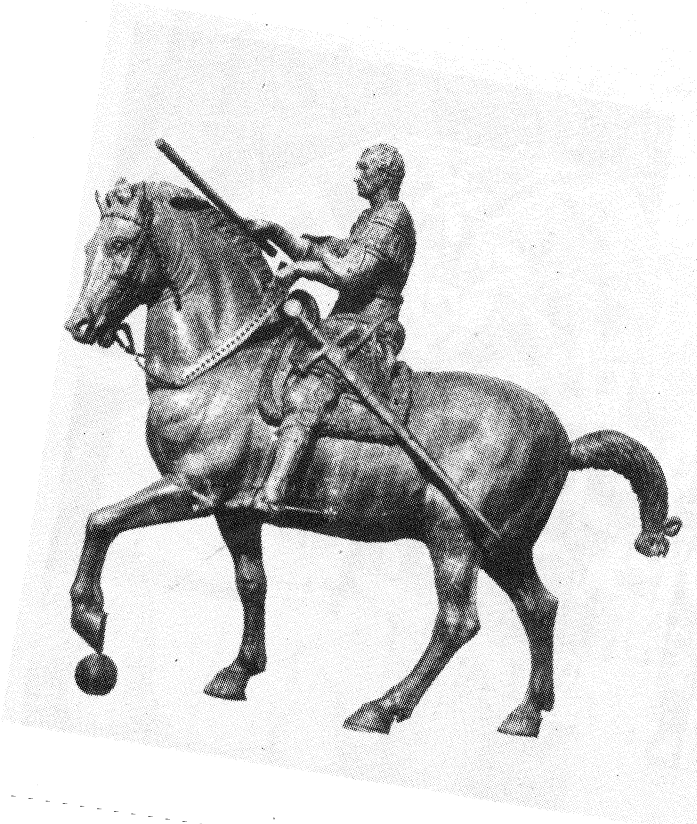

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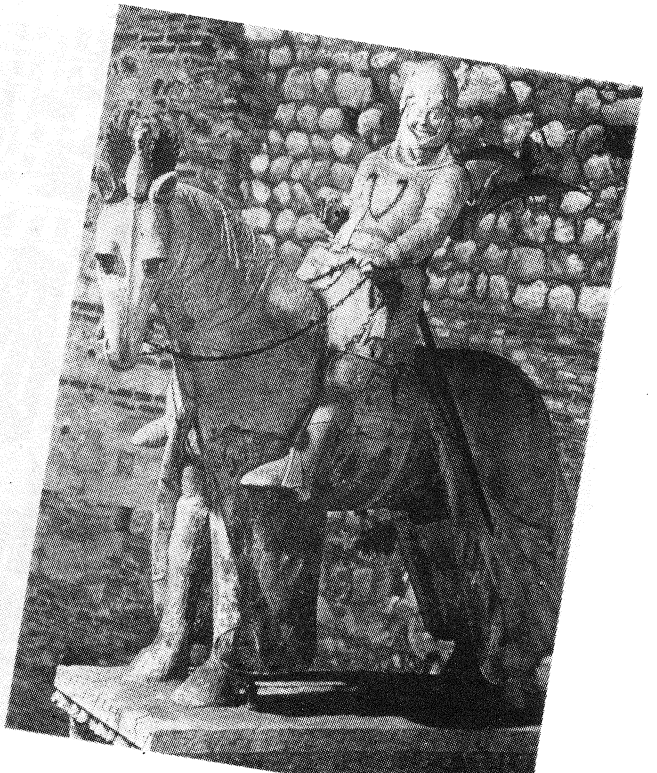

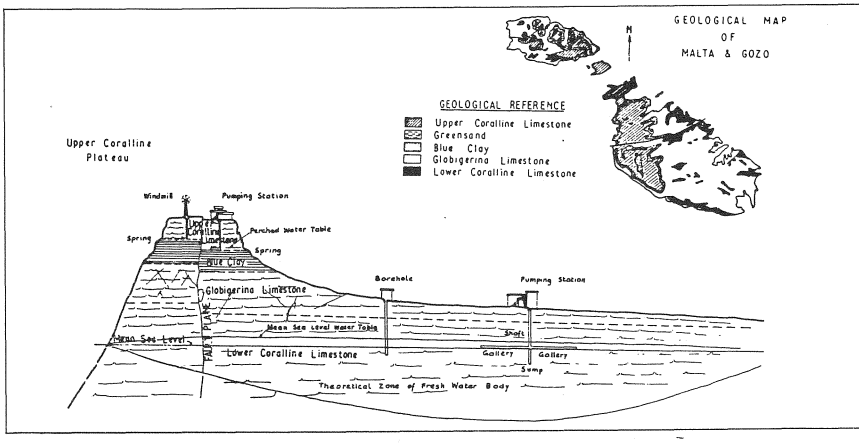

b) Tectonic Structures

The strata of Maltese rocks has a undulating regional dip to the South-East and the islands are cut by a system of normal faults striking East-North-East, which affects Malta especially and is responsible for cutting the island into a series of horst and rift blocks (block-faulting). The largest faultline in Malta is the Victoria Lines fault which structurally divides Malta into two regions – to the north of this faultline there is a series of rift and horst blocks which divide northern Malta into a series of valleys and ridges. South of the Victoria Lines fault, the faults are less conspicuous and it is from this area that most of our drinking water is supplied.

Hydrology

From the total amount of rainfall over the Maltese Islands about 6 per cent is lost by direct run-off to the sea, 75 per cent is lost through evapotranspiration and the remainder percolates through the rocks and collects into two natural underground rock reservoirs. These form two distinct aquifers, one in the Upper Coralline and the other in the Lower Coralline and Globigerina formations.

The upper water-table has been broken by faulting and the Upper Coralline limestone aquifers, in which water movement is controlled mainly by fissures, are often thin so that storage possibilities are limited. It is the high-standing water-tables, sealed off by the Blue Clay beneath, which are the most important, particularly in the Miżieb and Binġemma Basins, where perched synclines collect water from the neighbouring uplands. Most of this water from the Upper Water-Table is used for irrigation but also about two million gallons are used as public water.

There is another subdivision of water-tables based on sea-level and those developed above impermeable strata. The main sea-level water-table is the source of public supply in Malta and this reservoir accounts for about ten million gallons. This water-table owes its existence to the simple fact that every winter the local rainfall adds more fresh water to the underground store that can be dissipated by: a) the direct discharge of its superficial portion around the coast in response to the head of water inland, b) the deterioration of its composition as the result of diffusion from the highly-saline sea waters around it and beneath it. This forms a fresh water lens floating on top of a saturated zone of salt water.

The most valuable parts are those where the salinity of the top water does not exceed 15 parts per 100,000. The water body is replenished for the most part through the extremely limited outcrops of Lower Coralline since the Globigerina, especially where it is soil-covered, forms a region of very slow percolation. Therefore, it is important that Lower Coralline catchments should be preserved and protected from pollution. In some cases, they are built over – like in the Mt Carmel Hospital area, others are used as refuse dumps like Has-Saptan. Deep fissures result in the mixing of salt water.

Replenishment of the Upper Water Table, like that of the Lower, depends largely on the characteristics of the surface and it is here that we have a conflict of needs. The expansion of built-up areas over the Upper Coralline and since non-productive rocky land has been reclaimed and covered with soil, this resulted, especially in the latter case in reduction of percolation and created a bigger demand for irrigation water. In some areas over-pumping of water for agricultural purposes has occurred, like on the Rabat-Dingli Plateau. Growth of settlement increases both water consumption and pollution.

Production of Natural Water

Total production of public water from the water-table amounts to about twelve million gallons a day. This water is extracted by means of underground galleries and 150 boreholes scattered all over Malta and Gozo.

a. The Underground Galleries

The largest amount of water, about seven million gallons each day, collects in these underground galleries mainly found in the Lower Coralline Limestone. These galleries are serviced by twelve pumping stations, the largest of which is that at Ta' Kandja which pumps more than about one million gallons a day.

b. The Boreholes

In the 1970s boreholes started to be dug so that water production would be increased over and above that of the underground galleries. These boreholes are more economical to be excavated given the development of drilling rigs, and to be kept in working order. Up to now, about 150 boreholes have been dug and these produce about five million gallons of water each day.

c. Spring Water

A blue-clay formation situated in the western part of the island and located some 100 metres above mean sea-level is responsible for a number of perched aquifers which give rise to small springs at certain points.

Problems Encountered

Hydrogeology difficulties limit the amount of water that can be pumped from the aquifers and the yield is not sufficient to satisfy the local demands by industries and tourism.

In some areas there is a gradual increase in the chloride resulting from over exploitation and nitrate content presents a very serious problem in some sources. This has been partly solved by either blending with better water or by keeping extraction rates under control. Unfortunately, like in many developed countries, the problems of nitrates in water supply has also been felt in Malta and efforts are being made to control the situation. The average daily production for Malta is about 61,800m^3/d.

Prior to 1971, ground water extraction failed to cope with demand and sea water desalination was introduced to supplement the total production of water from natural sources.

One of the drawbacks facing small islands is the problem of run-off water. This depends on the topography. Water must travel through our main drainage lines which cross the whole island before they discharge into the sea. Therefore, the Government constructed a system of small dams and water tanks to capture as much as possible the flow during the winter season. Other valleys are cleaned and larger earth dams are built such as at Girgenti valley. It is also proposed to include afforestation schemes by planting trees along the sides of valleys. Recreation areas are also being proposed in these areas for public use.

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