6.1. Introduction:

Pore-space configuration of the limestone mainly deals in petrophysics. Size, shape etc., characteristics of the pore-space, are the main function in evaluating the physical measurements such as porosity, permeability and capillary pressure of limestone.

6.2. Porosity:

Petrophysical studies of the limestone reveal primary and secondary porosities. These two porosities are evolved by the solution process during the time of sedimentation. Moreover, it is very difficult to make a demarcating line between primary and secondary porosity. Porosity is influenced by the crystal enlargements, texture and fabrics of constituent crystals and formed at the time of deposition and lithification. Two sub-types of porosities—intercrystalline and vuggy, represent the characteristics of primary porosity. Secondary porosity is represented as one subtype i.e., vuggy porosity.

At block no. I the values of porosity of the limestone are found to vary from 15.71 percent to 36.30 percent.

At block no. II and no. III the porosity of the limestone ranges from 8.57 percent to 68.70 percent and 8.57 percent to 68.71 percent respectively.
The average porosity percentage in the limestone of the present area is 21.16 percent.

6.2.1. Intercrystalline porosity:

Intercrystalline porosity occurs within and between microcrystalline calcite matrix during the lithification of limestone. This type of porosity is finest of all. The average pore-size of the limestone is 0.01 mm. This type of porosity is also designated as "mud porosity" (Harbaugh, 1967) or micrite porosity (Archie, 1952).

6.2.2. Vuggy porosity:

Vuggy porosity, a sub-type of primary and secondary porosity, found to occur within and between fossils and microcrystalline calcite matrix. An adequate number of pores remain unaffected by calcite crystals, but in few cases calcite crystals are found to develop and partially closed up the vugs or voids. The walls of the vugs are formed by the matrix. The pore-size of the limestone ranges from 0.01 mm to 0.23 mm. Occurrence of larger vugs within the fossils are rare. It is also found that the amount of intercrystalline porosity is more predominant than the vuggy porosity in the limestone.
6.3. Pore-size distribution (capillary pressure):

The percentages of the mercury saturation data are graphically plotted against the capillary pressure (Fig. 10 and Table 12). Parameters present in the capillary pressure curves of the limestone are measured, following Robinson (Robinson, 1966). The capillary pressure curves of the limestone are characterized by different points, such as R.S.U. The low pressure at R, suggests the initial displacement pressure for the bigger pores available in the limestone. The larger percentage of the pore-space in the limestones is usually occupied by mercury while pressure is increased. These capillary pressure curves plotted in the figure are mainly of one type. The trends of the capillary pressure curves of the limestone are mostly flat slope between R and S (Fig. 10), except for few samples which show steep slopes. These slopes of the curves provide the information of the pore size configuration in the limestone. The steep slope indicates the area in which medium to smaller pores are gorged progressively with the increase of pressure. Flat slope of the curve represents larger percentage of similar pore-sizes and shapes that are invaded by mercury at one displacement pressure. The C-factor, measure of the pore sorting, ranges from 0.52 (medium sorted) to 1.18 (Table 13) (poorly sorted) at block no. I. At block no. II it ranges from 0.71 to 1.00. C-factor varies from 0.52 to 1.18 in the limestone of block no. III. Medium sorted pore-spaces are mostly
found in the limestone. The size of the pores in the limestone is indicated by the initial displacement pressure \((P_d)\), varying from 10 PSI to 55 PSI. The terminal pressure at point 'U' of the capillary pressure curve relates minimum unsaturated pore-volume \((S_m)\) in percent in the limestone. Unsaturated mercury volume that is expressed in percent varies from 19 to 39 in block no. I. At block no. II it varies from 14 percent to 53.5 percent. Minimum unsaturated pore volume of the limestone (block no. III) ranges from 27 percent to 43 percent. The curves also express the saturation conditions that would prevail for the rock types under different capillary pressure.

6.4. Permeability:

Permeability is dependable upon the pore-diameters available in the limestones. Thin section study of the limestone shows that the pore-space of the limestone is mostly type II. This type of pore-space is used frequently to predict the 'effective reservoir' rock in finding of oil (Teodorovich, 1949 and Aschenbrenner and Chilingar, 1960).

The calculated permeability of the limestone of block no. I varies from 271 md to 643 md.

At block no. II calculated permeability ranges from 28 md to 449 md in the limestone.

At block no. III calculated permeability of the limestone varies from 17 md to 256 md.
The average calculated permeability of the limestone of the present area is 255 md.

The plot of the porosity and calculated permeability as a function of the average pore-diameter (Fig. 11 after Talash and Crawford, 1965) shows that the calculated permeability of the limestone increases with the increase of pore-diameter, but at the same time porosity decreases. It can also be expressed that the low porosity with high calculated permeability indicates the characteristics of medium pores or voids whereas high porosity with low calculated permeability represents smaller pores.