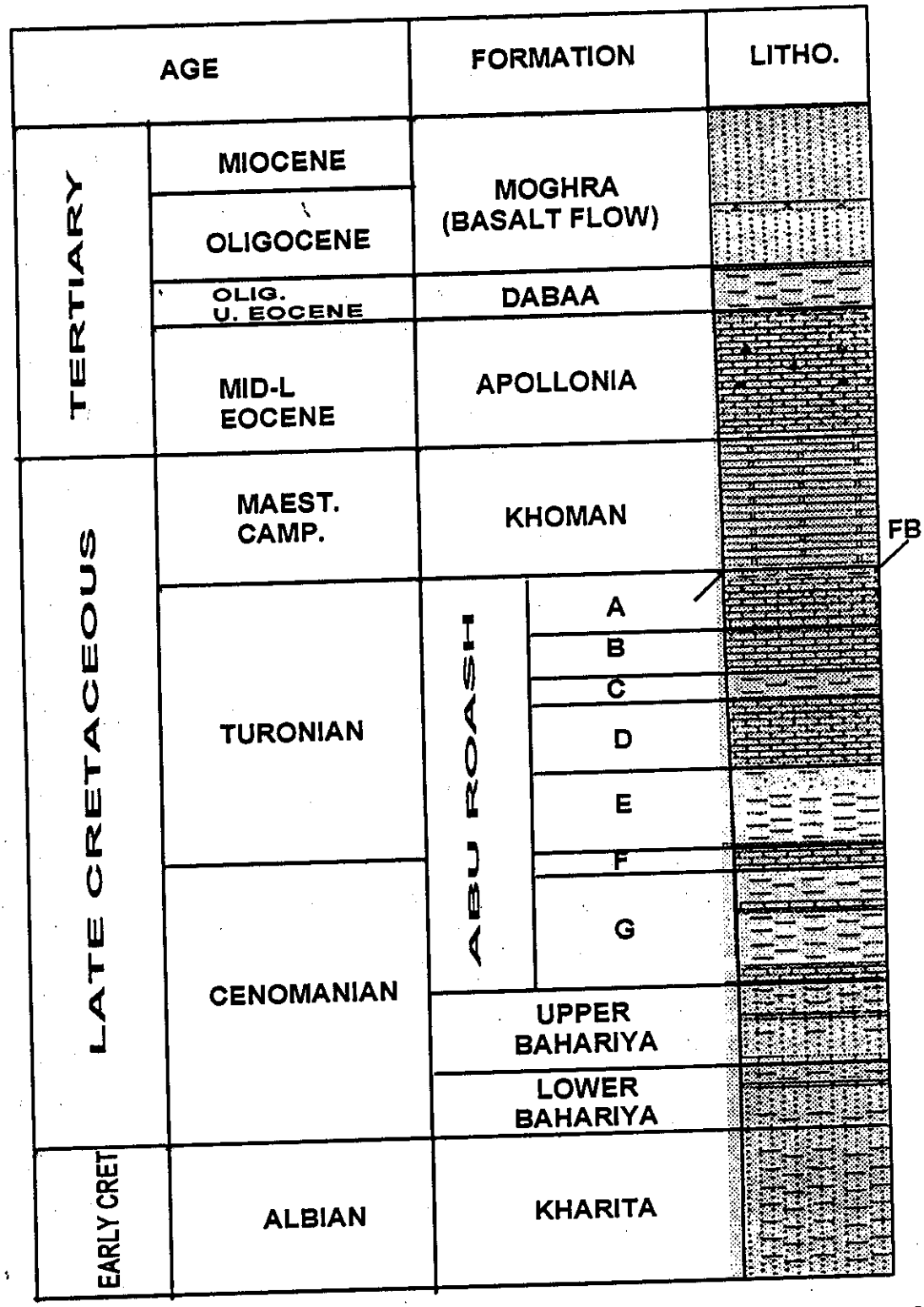

FIG. (3) GENERALIZED STRATIGRAPHIC SECTION OF QARUN CONCESSION.

(AFTER NEMEC,1996)

referred as the Albian Kharita Formation and Lower Bahariya Formation (***Schlumberger, 1984).*** They were deposited in shallow marine and fluvio-deltaic environments. Kharita Formation is mainly formed of argillaceous sandstone and its lower part contains high content of shale. In the study area, the drilling reaches to Kharita Formation only in two wells : Qarun G-1X and East Qarun in the north western part of the area.

B- Upper Cretaceous:

The Upper Cretaceous basins are represented by three embayments, one occurs in Gindi and shifts slightly to the north, the second occupies Mubarak area, and the third lies to the west of the study area. These embayments are separated by two highs (Kattaniya and Mubarak) having NNE trend (***Tammam, 1996***).

It was characterized by active deformation and faulting of the basement, accompanied by a prominent southward transgression of the sea ***(Shlumberger, 1984)***. The rock units of the Upper Cretaceous are as follows:

1 - Bahariya Formation:

This name was proposed by ***Norton (1967)*** for exhibiting the Lower Cenomanian fluvio-marine conditions, and to composed of fine to very fine grained sandstone with pyrite, glauconite, and minor intercalations of shale and marly fcaies. ***Abu El Ata (1981)*** subdivided the Bahariya Formation into two smaller units, a lower one consists of sandstone with shale, limestone and dolomite and an upper one consists mainly of sandstone with shale.

The thicknesses of lower Bahariya interval in the different wells show great variation as follow: Qarun G-1X (202 m), Gindi Deep-1X (84 m), N.B.Q.-1X (26 m), N.B.Q.-2X (247 m), East Qarun (338 m) and Qarun 3-1 (183 m). The thicknesses of upper Bahariya section in the different wells are

shown as follow: Qarun G-1X (213 m), Gindi Deep-1X (169 m), N.B.Q.-1X (210 m), N.B.Q.-2X (174 m), East Qarun (32 m) and Qarun 3-1 (270 m).

2 - Abu Roash Formation:

This formation was named by ***Norton (1967)*** to designate the marine neritic to open basinal facies, that prevailed in the northern Western Desert during the Late Cenomanian-Turonian-Coniacian-Santonian. It was subdivided into seven members designated from bottom to top as G, F, E, D, C, B and A. The rocks forming these members are mainly composed of calcareous rocks with argillaceous intercalations in the A, B, D and F members and argillaceous rocks are dominant with calcareous and arenaceous interbeds in the members C, E and G. In the study area, its thickness varies from well to the other as shown: Qarun G-1X (1126 m), Gindi Deep-1X (602 m), N.B.Q.-1X (945 m), N.B.Q.-2X (714 m), East Qarun (1157 m), Qarun-DT (1994 m) and Qarun 3-1 (799 m).

3 - Khoman Formation:

The name of this formation was proposed by ***Norton (1967)*** for representing the open marine facies with a relatively deep-water biota, which precipitated chalk during the Campanian-Maestrichtian in the northern Western Desert. It exhibits two main units, the lower unit is mainly shale with highly argillaceous limestone and the upper unit consists of white chalky limestone with chert bands. In the study area, the thickness of Khoman Formation varies as follow: Qarun G-1X (600 m), Gindi Deep-1X (238 m), N.B.Q.-1X (501 m), N.B.Q.-2X (215 m), East Qarun (651 m), Qarun-DT (455 m) and Qarun 3-1 (419 m).

I-3-2 – Cenozoic Rock Units:

During the Paleogene, open marine conditions continued to extend further south into Upper Egypt. During the Late Eocene-Oligocene, thick open marine calcareous shale (Dabaa Formation) was deposited in the northern parts of the Western Desert. The Neogene started with a regression and then a deposition of neritic shallow water calcareous shales in the extreme northern reaches of the Western Desert. Marine Pliocene deposited a fringe toward the coast of the Mediterranean Sea in the form of shallow marine pink limestone or its lateral equivalent.

Several rock-stratigraphic classifications for the Cenozoic rocks of the northern Western Desert had been proposed by several authors, such as: ***Beadnell (1905), Said (1961), Norton (1967), Eloui*** and ***Abdine (1972), Omara*** and ***Ouda (1972)*** and others.

I-3-2-1 – Paleocene-Eocene:

A - Apollonia Formation:

This rock unit was named by ***Norton (1967)*** and renamed by ***Eloui and Abdine (1972)*** as El-Gindi Formation referred to the developed open marine section (1805 m) north of the Fayum Depression. Moreover, the name Apollonia is probably suitable for the shelf limestones of the northern Western Desert ***(Hanter, 1990)***. This formation is composed essentially of limestone alternating with fossiliferous and gypsiferous shales. Within the study area, the thickness of Apollonia Formation shows great variation in the study area and reached to 2169 m in Qarun 3-1 well, 2113 m in N.B.Q.-1X well, 1867 m in N.B.Q.-2X well, 1769 m in Gindi Deep-1X well, which represents the southern part of the study area, 572 m in East Qarun well, 440 m in Qarun-DT well and 280 m in Qarun G-1X well in the north.

I-3-2-2 – Upper Eocene-Oligocene:

A - Dabaa Formation:

This name was introduced by ***Norton (1967)*** to exhibit the Upper Eocene-Oligocene Fluvio-marine facies in the northern Western Desert. This formation has been previously given various names: Maadi, Birket Qarun... ***(Hanter, 1990).*** It consists of carbonaceous shales, with some interbeds of glauconitic and sandy limestone. In the study area, the Dabaa Formation thickness is ranged from zero in Qarun 3-1 well to its maximum thickness in N.B.Q.-1X well (173 m). But in other wells such as, Gindi Deep-1X it is (154 m), N.B.Q.-2X is (130 m), Qarun-DT is (114 m), Qarun G-1X is (109 m) and East Qarun is (88 m).

I-3-2-3 – Miocene:

6 - Moghra Formation

According to ***Said (1962)***, the Moghra Formation is a clastic fluvio-marine delta-front sequence of Early Miocene age. The type section of the Moghra Formation is the classic surface section at the eastern tip of the Qattara depression (230 m). It is composed of sandstone, siltstone and calcareous shale. The thickness of Moghra Formation in the study area has greater thickness in the northwestern wells, such as : Qarun G-1X (579 m.), Qarun-DT (540 m.), and (525 m.)in East Qarun well. It is highly reduced in thickness in N.B.Q.-2X and Gindi Deep-1X wells (145 m.) and (107 m.) in N.B.Q.-1X well, while in the eastern part around Qarun 3-1 well, the Moghra Formation is completely absent.

According to the previous stratigraphic subdivisions of the rock units, seven well summery sheets were established for Qarun G-1X, Gindi Deep-1X, N.B.Q.-1X, N.B.Q.-2X, East Qarun, Qarun-DT and Qarun 3-1 wells, as shown