SCIENTIFIC NOTE

CALCRETE DEVELOPMENT IN DARBANDI KHAN – SARTAQ BAMMU AREA, NE IRAQ

INTRODUCTION

The studied area, Darbandi Khan – Sartaq Bammu, is located in the northeastern part of Iraq, along the Iraqi – Iranian international borders, about 50 Km southeast of Sulaimaniyah city (Fig.1), forming the southwestern limb of Bammu anticline. The studied area is characterized by well development of calcrete. The calcrete, as other Quaternary sediments is not well studied and presented in geological maps all over the Iraqi territory, though they cover considerable areas with different thicknesses.

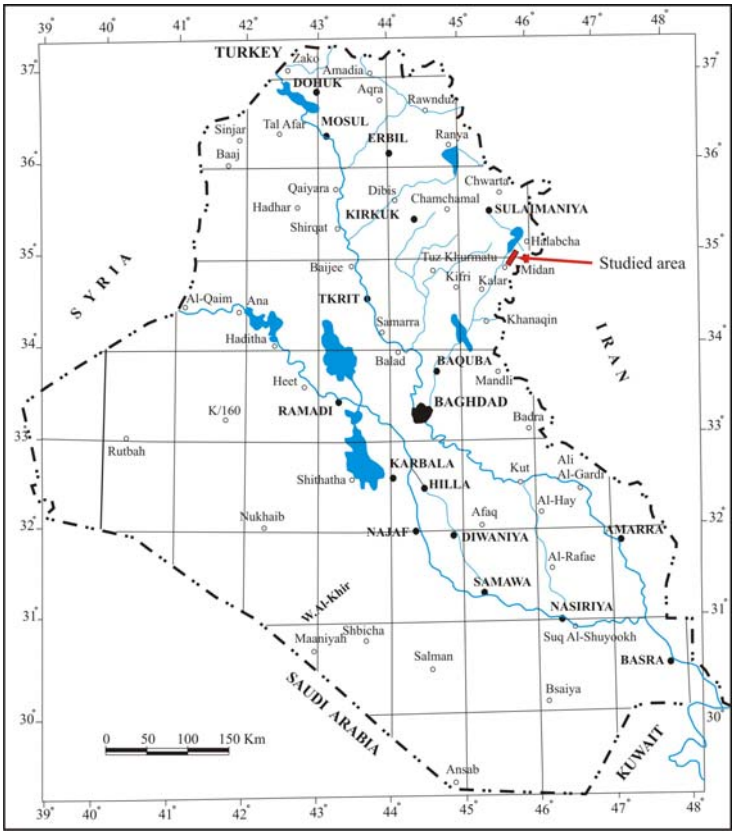

Fig.1: Location map of the studied area

GEOLOGICAL SETTING

The studied area is located within the High Folded Zone of Iraq (Al-Kadhimi *et al*., 1996) of the Outer Platform (Unstable Shelf), which belongs to the Arabian Plate (Fouad, 2012). The exposed rocks in the studied area belong to the Pila Spi, Fatha, Injana, Mukdadiya and Bai Hassan formations (Sissakian, 2000). The Pila Spi Formation (Middle – Late Eocene) consists mainly of well bedded and hard carbonates. The Fatha Formation (Middle Miocene) consists of alternation of red claystone, marl and limestone with subordinate gypsum beds. The Injana (Late Miocene) and Mukdadiya (Late Miocene – Pliocene) formations consist of alternation of sandstone and claystone, some of the sandy beds in the latter formation are pebbly. The Bai Hassan Formation (Pliocene – Pleistocene) consists of alternation of conglomerate and claystone, with intercalation of some sandy beds.

Geomorphologically, the beds of the Pila Spi Formation form continuous anticlinal ridges, dipping (30 – 55)º SW, with height of about (50 – 200) m, due to the very hard and thickly bedded to massive carbonates (Fig.2). The remaining formations form cuestas and hogbacks (Fig.3), due to alternation of hard and soft rocks. Locally, along the dissected slopes, calcrete is very well developed, capping the slopes in form of plateaus, which form very gentle slopes over the moderately dipping Fatha, Injana and Mukdadiya formations (Fig.4).

Fig.2: Steep beds of the Pila Spi Formation

Fig.3: Cuesta and hogback within the Fatha Formation.
Note the continuous calcrete plateaus forming gently sloping landscape,
And continuous ridge of the Pila Spi Formation in the background

Fig.4: Calcrete forming plateau. Note the flat gently sloping top of the plateau and Bai Hassan Formation in the back ground

DISCUSSION AND CONCLUSIONS

The calcrete sediments, in the studied area consist mainly of carbonate rock fragments. The calcrete consists of angular fragments, which range in size from few centimeters to about 3 m (Fig.5), but the dominant size is about (0.5 – 2) m. However, exceptionally the boulders may reach 10 m, but they decrease in size in the marginal parts of the slopes. The fragments and blocks consist mainly of limestones, though not paleontologically checked, but most probably belong to Pila Spi Formation; however some very fine crystalline, very hard, splintery and light pinkish brown limestone fragments may belong to Anah Formation (Oligocene) (Fig.6), although the geological map does not show Oligocene rocks in the studied area, but they are exposed southwards of the studied area overlying the Pila Spi Formation (Barwary and Slewa, 1995 and Sissakian, 2000). The fragments are cemented by calcareous material, forming very hard groundmass, which forms the plateaus; however, locally the blocks and/ or the boulders consist of cemented angular rock fragments (Fig.7). The thickness of the calcrete ranges from (2 – 15) m. The presence of many plateaus in the studied area, indicate the presence of an old peni-plain, which is dissected to small pieces due to active erosion, forming the nowadays landform plateaus.

Fig.5: Angular blocks within the calcrete.
Note the height of the trees is (1.5 – 3) m

Fig.6: Very fine crystalline, very hard, splintery and light pinkish brown limestone fragment (?Anah Formation)

Fig.7: Angular fragments forming a single block within the calcrete

The calcrete was developed during the prevailing of warm and wet climate phases during the Pleistocene, which witnessed many fluvial and pluvial phases (Gradstein *et al*., 2004), this is evidenced by finding the terraces of Diyala (Sirwan) River in very well correlation levels with the calcrete, especially of its marginal parts (Fig.8). It is very similar to the Pleistocene terraces, which are well developed in the near surroundings, but with main differences in the shape and type of the constituents.

The calcrete covers, locally the ground mass of Fatha, Injana and Mukdadiya formations, starting from the slopes of the Pila Spi Formation (Fig.9). The calcrete was developed as a continuous plain, due to flowing water, from the slopes of the main ridge, which consists of Pila Spi Formation. The effect of the water over the marginal slope of the ridge is still clear on the uppermost part of the Pila Spi Formation (Fig.10). The water was carrying disintegrated rock fragments and boulders; cementing them by calcareous materials, giving them the hard nature of the calcrete (Figs.4 and 7). After the end of the fluvial wet phases, during Holocene, the erosion started to dissect the whole calcrete plain to blocks of different sizes, giving rise to the present landscape of the studied area. However, some calcrete may be developed in closed depressions, but this type was not found in the studied area.

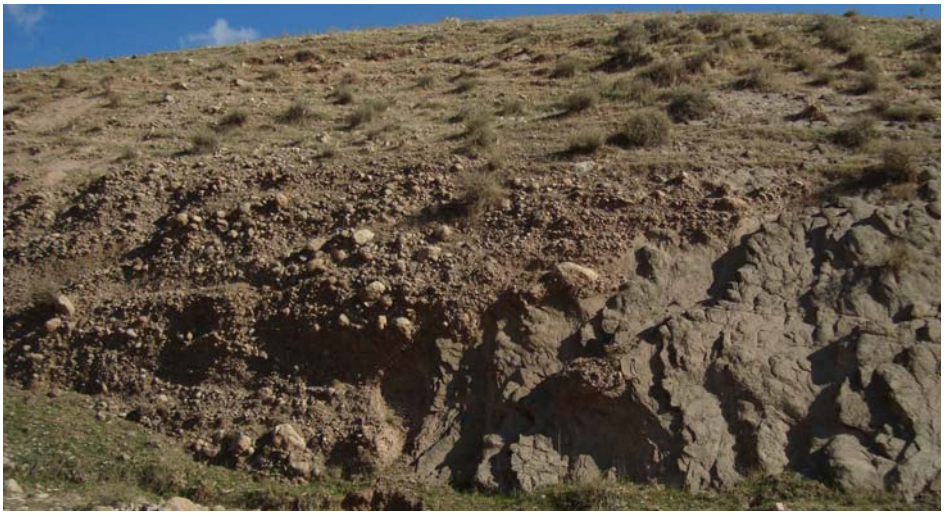

Fig.8: Terraces of Diyala (Sirwan) River overlying Mukdadiya Formation in the marginal part of the calcrete plateau

Fig.9: Excavated slope on the top of the Pila Spi Formation. Note the partly cemented fragments, forming the initial stage of calcrete development

Fig.10: Limestone bed in the uppermost part of the Pila Spi Formation, showing striation due to water (solution) effect

It is worth mentioning that southwards of the studied area, in Maidan vicinity (Fig.1), Youkhanna and Hradecky (1978) mapped a special lithological unit and called it the Upper Unit of ex-Upper Bakhtiari Formation (Bai Hassan), claiming that the unit caps different formations of different ages, starting from Oligocene to Pliocene ages. Jassim *et al*. (1984, 1986 and 1990) renamed the involved unit as "Bammu Conglomerate" and mentioned that the blocks and boulders are mainly of angular limestones, up to 4 m in size. Sissakian (2000) adopted the idea of Jassim *et al*. (1986 and 1990). However, Sissakian and Fouad (2012), denied the presence of Bammu Conglomerate and claimed that they are either talus sediments or calcrete. The author believes that the studied calcrete sediments in Darbandi Khan – Sartaq Bammu area are similar to those sediments described by Youkhanna and Hradecky (1978).

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