IRAQI Academic Scientific Journals

Samarra Journal of Pure and Applied Science

SJPAS

www.sjpas.com

p ISSN: 2663-7405
e ISSN: 2789-6838

Heavy Minerals Distribution in South Hammar Marsh, Southern partof Mesopotamia

Khaleel J. Alsudani[1*], Badir N. Albadran[2], Liviu Giosan[3]

1Department of Geology, College of Science-University of Basrah, Basrah, Iraq
2 Almaaqal University, Basrah, Iraq
3 Woods Hole Oceanographic Institution, USA

https://doi.org/10.54153/sjpas.2022.v4i1.335

Article Information

Received: 08/12/2021
Accepted: 16/01/2022

Keywords:

Petrography, Heavy, Minerals, Hammar Marsh, Mesopotamia

Corresponding Author

Email: khaleel.mola@uobasrah.edu.iq

Mobile: 07710858118

Abstract

Four sites south of Al-Hammar Marsh southern part of Mesopotamia were selected and dug at different depths. The first site is at a 2m depth, the second site is 4 m, the third and fourth sites are 9m. The results of the analyzes of heavy minerals showed different types, where opaque minerals dominated with a percentage of 35.15%, followed by the transparent minerals, Chlorite, Hornblende, Muscovite, Zircon, Biotite and Epidote. The tripartite chart indicates, the studied samples are considered medium stability and close to being highly stable. The sediments of the study area were characterized by stable minerals because they contain a high percentage of opaque minerals in addition to a high percentage of ultra-stable minerals. The largest part of the sediments of the study area is the result of weathering of rocks from elevated areas in one cycle and with a rapid transport process that reduces the effect of weathering, which is inferred from the presence of unstable minerals in the sediments and that the presence of unstable minerals such as hornblende and pyroxene is evidence that the area of origin is of a climate dry or semi-dry, which means that mechanical weathering of the original rocks is more effective than chemical weathering.

Introduction

The study area is located within the Mesopotamia zone, specifically within the Zubair subzone of unstable plate [1]. This zone contains stratigraphic sequences whose ages were determined, starting from the early Tertiary to the Quaternary.There are many water bodies, lakes and marshes in the areas, as well as marine sediments dating back to the Holocene era, containing fossils. (Bryoza, Crab, and Gastropod) and shells [2]. The recent sediments of the Mesopotamian plain were deposited about 5,000 years ago during the period of marine transgression, which covered a distance ranging between (130-150) km [3].

The fluctuations in sea levels and climatic conditions, as well as the recent tectonic activity during the geological ages that accompanied the phases of the Tigris-Euphrates- Karun delta during 10,000 years ago, have contributed in their entirety to the deposition of various sedimentary units, which were reflected on the diversity of sedimentary processes and the accompanying diagnosis processes in connection with the prevailing climatic variables [4].

The lower part of the Mesopotamian plain represents a complex area in terms of geomorphological-hydrological. It contains many secondary sedimentary environments, the most important of which are areas of fresh, brackish and relatively saline lakes, sabkha, tidal flats and marshes and through which several rivers pass with their alluvial manifestations such as natural and cut banks [5]. The southern part of the alluvial plain in Iraq is characterized by the presence of a large swamp area, which is locally called the Marshlands. The marshes are shallow water bodies that feed from the waters of the Tigris and Euphrates Rivers, and the sedimentary environment in them can be considered a model for sedimentation in fresh water located within the arid and semi-arid regions of the world. The Hammar marsh was chosen for this study because it represents the largest part of the permanent marshes in Iraq. The study of heavy minerals helps in distinguishing the quality of the sedimentary environment and the source of sediments and to predict the mineralogical composition of the Parent rock [6], in addition to its importance in knowing and estimating the distance of transporting detrital grains and the quality and degree of weathering depending on the proportions of Ultra- Stable Minerals. The study of these minerals can also be used in the reconstruction of the ancient geography and the secondary topography and the degree of transformation of the source rocks and the restructuring of old drainage basins [7] or used in stratigraphy correlation when there are no fossils in sedimentary layers. [8,9] Estimating the proportions and types of super-stable heavy minerals are also used to know the mineralogical maturation of the sandy rocks that contain them [10].

Materials and Methods

Four sites were chosen for sampling distributed in the study area. Twenty sediment samples were collected from these sites; sites have been fixed by GPS (Fig. 1). Four boreholes were drilled in the study area at different depths; in site one to a depth of 2m, and in the second site to a depth of 4m. While in the third and four sites to a depth about 9m below the ground surface of the area by using two inches diameter tubes with one- meter length connected by sockets and used for coring, using a hummer machine to push the tubes downward the ground. After taking the cores out in tubes, the tubes ends for each one meter were covered with tape recording the depth on both sides of the tube. In the lab the tubes were carefully cut longitudinally from both sides, and visual description was done according to the variation in colors and any sedimentary variation of texture or sedimentary structures (Fig. 2 and 3).

The sampling was done along the core according to their indicated variations and was put in plastic bags; the sampling was carried out for each 5 cm along the tube and samples were sorted and selected through the general description of the bed. The method of separating heavy minerals included the addition of 17% Acetic acid was added to each sample in order to remove the carbonate materials until the end of the reaction and then add 10% of H_2O_2, until ending of reaction to remove organic matters, and then the samples were wash with distilled water and dray sample at 50°C. The added sample were passed to sieve of 0.063mm and then washed with distilled water to remove salt and mud (clay and silt), the part which cumulates above the 0.063mm sieve represented sand fraction and five grams of these sizes were used for minerals separation, using heavy liquid (Bromoform) with a specific gravity of 2.89. The heavy minerals fraction and light components was then washed on filter paper with acetone, dried out and part of them mounted on glass slides with Canada balsam for petrographic study.

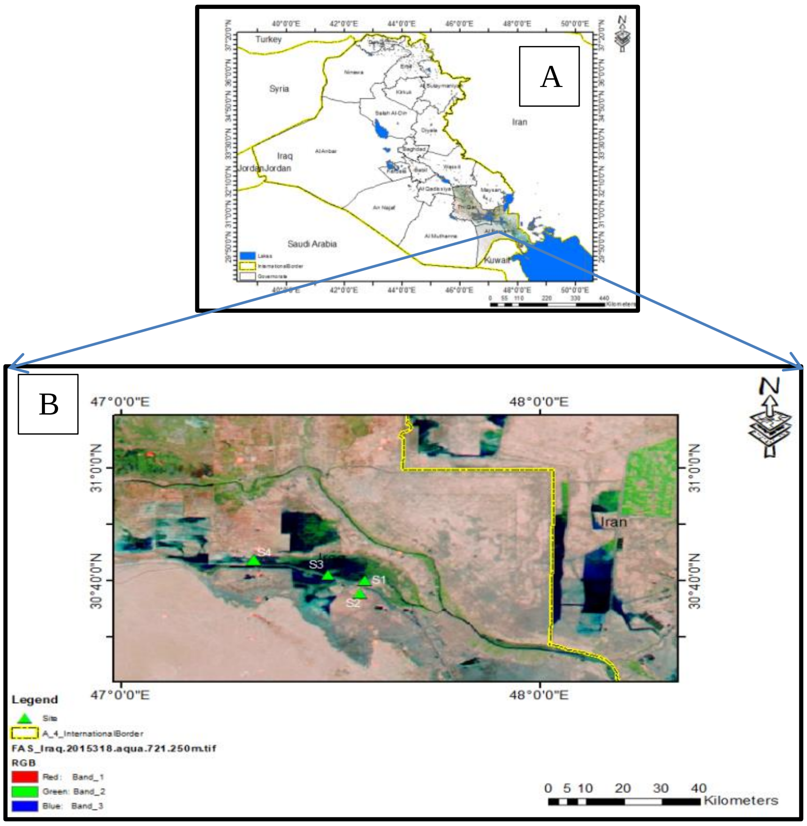


Fig. 1- A. Location map of the study area, B- The Location of the studied borehole.

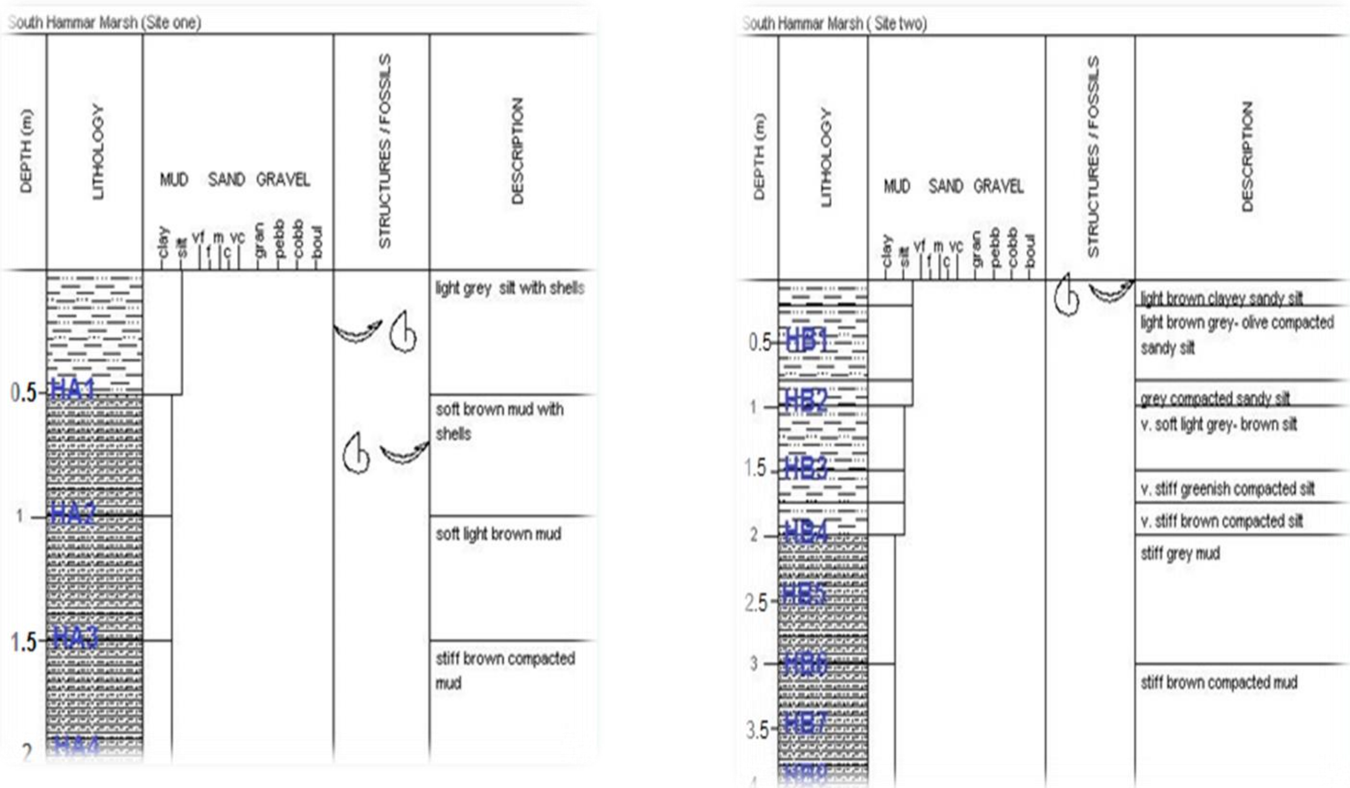


Fig. 2. Visual description of the cores one and two sites.

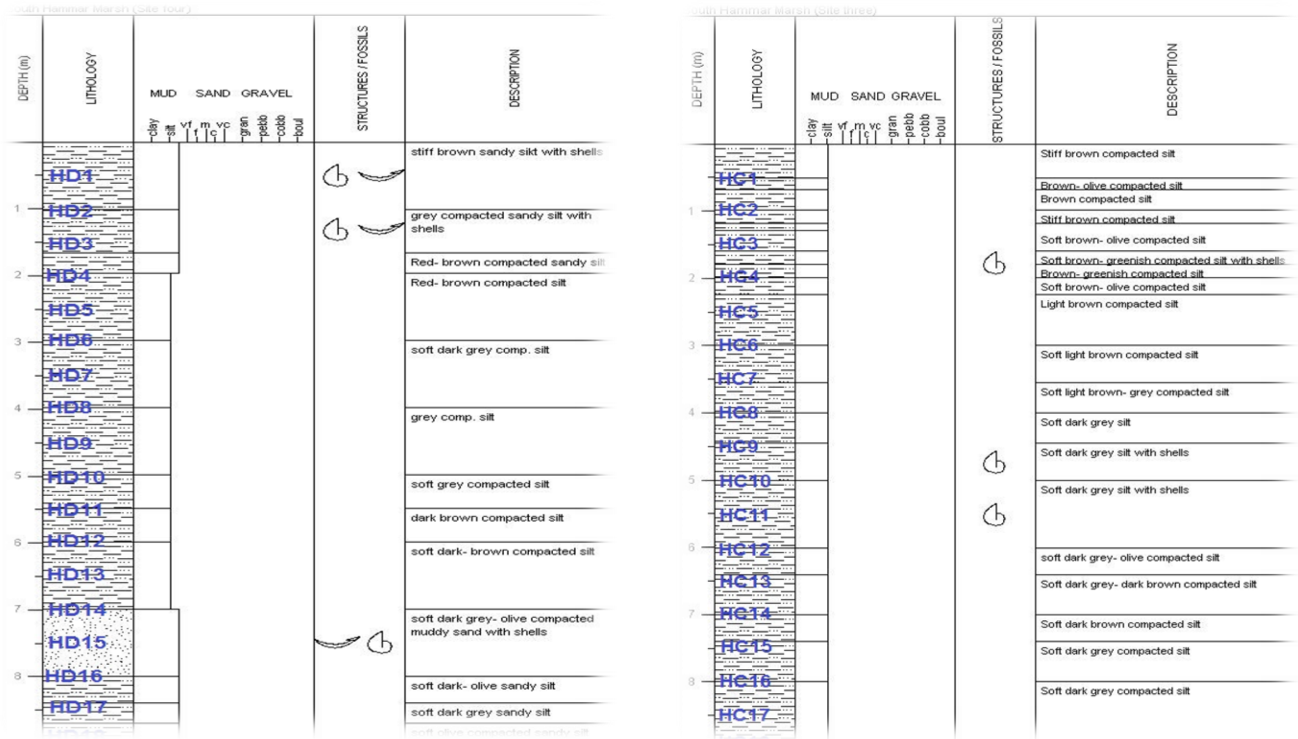
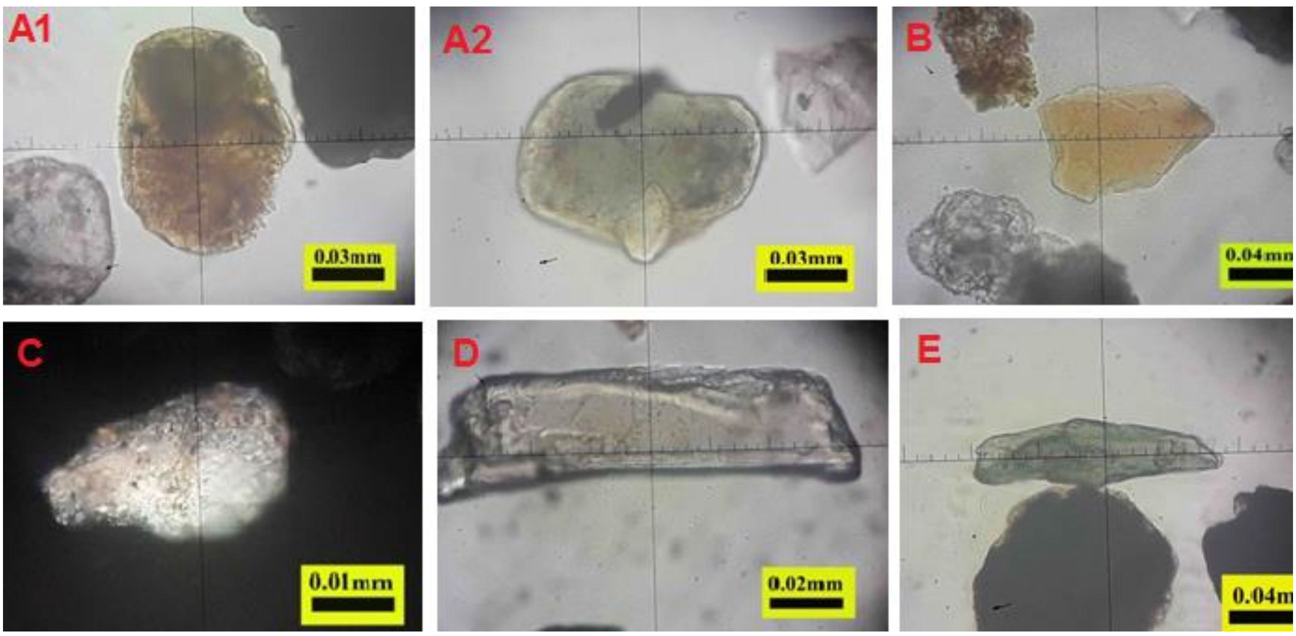


Fig. 3. Visual description of the cores three and four sites.

Results

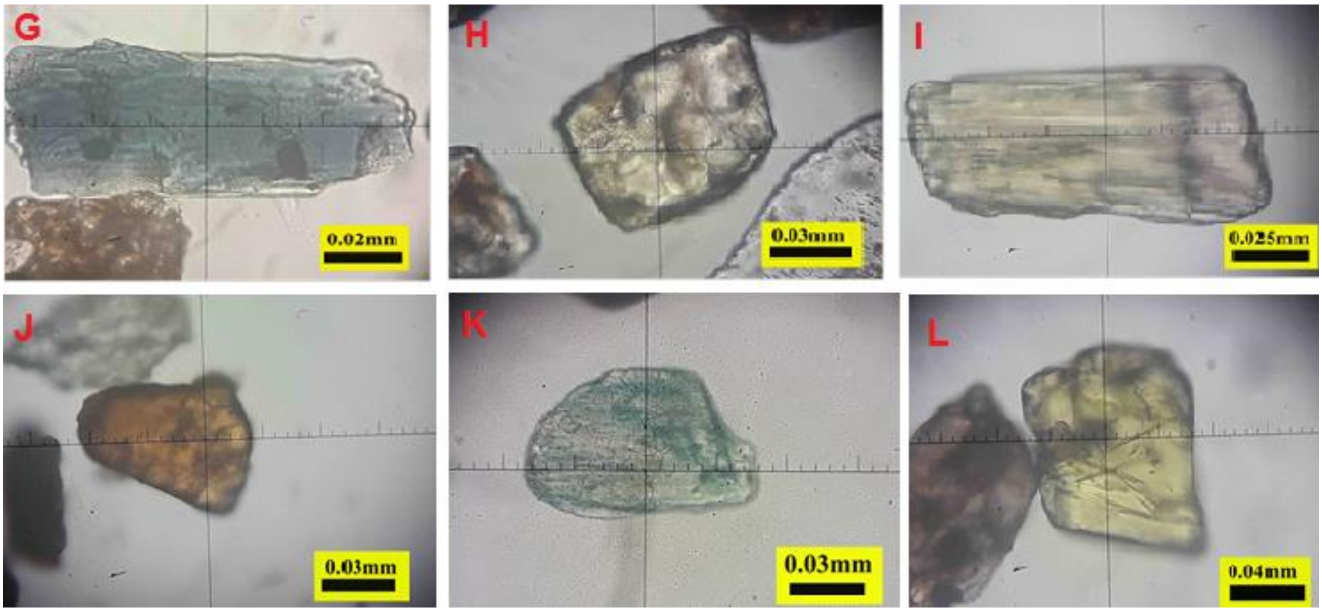
Heavy minerals were identified (plates 1, 2, and 3) in the sediments of south Hammar Marsh and for the four study sites (Table 1). These minerals are divided into two types; Opaque and transparent.

Plate (1).



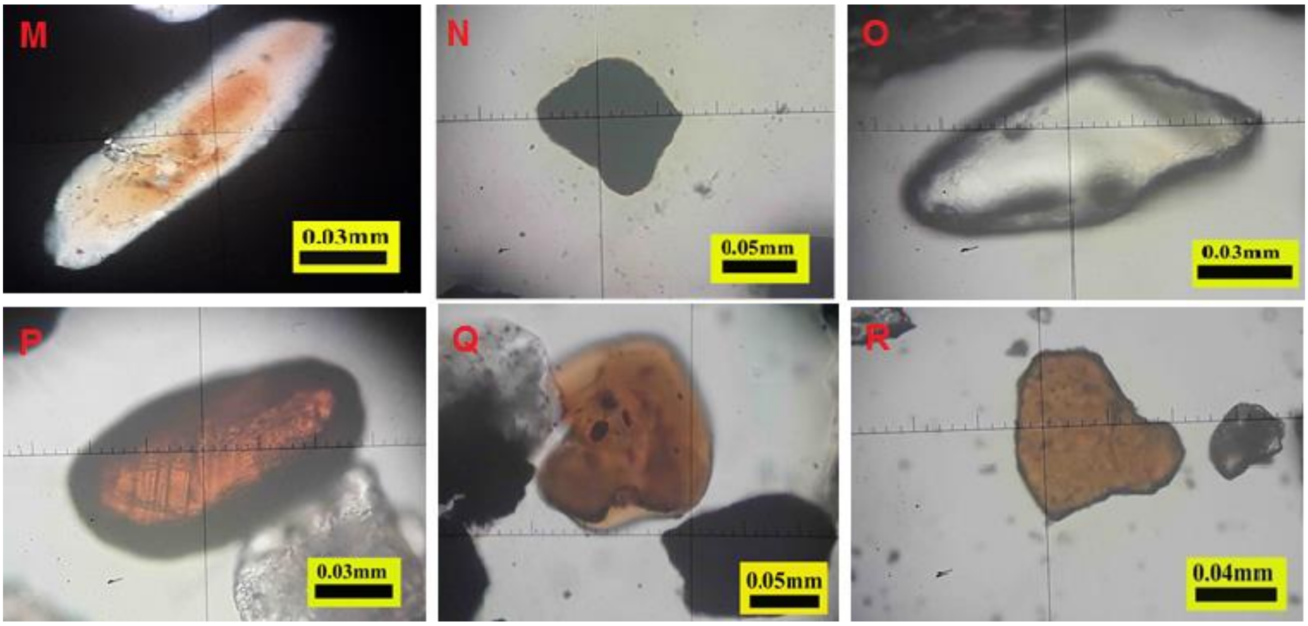
A1-Chlorite, A2- Chlorite, B- Biotite, C- Muscovite, D- Kyanite, E- Hornblende.

Plate (2).



G- Glaucophane amphibole, H- Garnet, I- Orthopyroxene, J- Rutile, K- Clinopyroxene, L- Epidote.

Plate (3).



M- Celestite, N- Iron oxide, O- Zircon, P- Rutile, Q- Tourmaline, R- Staurolite.

Table 1: Heavy minerals percentage in south Hammar marsh.

			Heavy Mineral																
				Ultra-stable			Unstable				Meta-Stable					Mica			
Sites	Sample NO.	Depth (m)	Opaques	Tourmaline	Zircon	Rutile	pyroxene (Orthopyroxene)	pyroxene (Clinipyroxene)	Amphibole (Glaucophane)	Amphibole (Hornblende)	Staurolite	Kyanite	Garnet	Epidote	Celestite	Muscovite	Chlorite	Biotite	Others
Site one	HA1	0.5	36.2	4.7	6.4	2.7	2.4	5.4	1.2	6.6	1.5	1.4	4.6	5.8	0.9	6.4	7.5	5.7	0.6
	HA2	1	32.8	4.4	7.7	2.6	2.0	4.7	-	7.3	1.4	1.5	5.1	6.5	1.2	7.4	9.6	4.9	0.9
	HA3	2	38.5	3.6	5.9	3.6	2.3	5.4	-	6.4	2.1	1.2	5.4	5.5	-	5.7	7.4	6.1	0.9
	HA4	2.5	33.2	4.2	5.4	4.6	2.4	4.7	1.5	8.4	2.4	1.8	3.7	6.2	0.9	4.5	9.3	5.3	1.5
Range			32.8-38.5	3.6-4.7	5.4-7.7	2.6-4.6	2-2.4	4.7-5.4	1.2-1.5	6.4-8.4	1.4-2.4	1.2-1.8	3.7-5.4	5.5-6.5	0.9-1.2	4.5-7.4	7.4-9.6	4.9-6.1	0.6-1.5
Average			35.175	4.22	6.35	3.37	2.27	5.05	1.35	7.175	1.85	1.47	4.7	6	1	6	8.45	5.5	0.97
Site two	HB1	0.5	34.1	5.1	5.9	4.1	3.2	4.8	0.9	5.7	1.8	2.1	4.4	5.3	0.6	5.4	8.2	7.2	1.2
	HB2	1	36.6	4.4	6.2	2.3	3.0	2.7	-	6.5	2.0	2.2	4.4	6.4	1.5	6.3	7.9	6.7	0.9
	HB3	2	34.5	4.7	7.5	3.6	2.8	2.7	-	7.4	1.4	1.8	5.4	6.3	1.2	6.3	8.1	5.7	0.6
	HB4	4	31.7	3.5	5.1	4.8	2.4	5.8	0.6	7.4	2.1	1.5	4.5	4.6	0.9	8.1	9.2	6.3	1.7
Range			31.7-36.6	3.5-5.1	5.1-7.5	2.3-4.8	2.4-3.2	2.7-5.8	0.6-0.9	5.7-7.4	1.4-2.1	1.5-2.2	4.4-5.4	4.6-6.4	0.6-1.5	5.4-8.1	7.9-9.2	5.7-7.2	0.6-1.7
Average			34.22	4.42	6.17	3.7	2.85	4	0.75	6.75	1.825	1.9	4.675	5.65	1.05	6.52	8.35	6.47	1.1
Site three	HC1	0.5	37.3	4.4	5.2	3.3	3.2	5.5	-	6.4	2.4	2.1	5.4	5.1	-	5.3	7.7	5.5	1.2
	HC2	2	38.6	3.6	5.9	2.9	2.9	3.9	0.8	6.6	1.9	1.9	4.7	5.5	0.8	5.7	8.7	5.6	0.8
	HC3	3	35.6	4.1	6.2	3.3	3.1	4.6	2.0	6.7	2.3	2.2	5.3	6.4	0.4	6.2	8.5	4.8	0.9
	HC4	5	37.5	3.6	6.3	4.2	3.4	3.8	0.8	7.4	3.3	1.7	5.7	4.7	1.3	6.8	7.4	5.8	0.6
	HC5	7	34.9	4.3	7.4	4.5	3.8	3.9	0.8	7.8	2.4	1.6	4.2	5.7	1.2	7.7	7.9	6.6	1.6
	HC6	9	36.9	3.9	6.6	4.2	3.2	3.8	0.7	7.4	2.5	1.7	4.4	6.4	0.9	7.5	8.2	6.8	0.7
Range			34.9-38.6	3.6-4.4	5.2-7.4	2.9-4.5	2.9-3.8	3.8-5.5	0.7-2	6.4-7.8	1.9-3.3	1.6-2.2	4.2-5.7	4.7-6.4	0.4-1.3	5.3-7.7	7.4-8.7	4.8-6.8	0.6-1.6
Average			36.8	3.98	6.26	3.73	3.26	4.25	1.02	7.05	2.46	1.86	4.95	5.63	0.92	6.53	8.06	5.85	0.96
Site four	HD1	1	33.7	5.4	5.8	3.4	2.9	5.4	-	6.9	1.3	1.3	6.4	5.6	0.8	6.9	9.1	5.7	1.8
	HD2	3	34.7	4.7	6.1	3.5	2.3	4.7	0.5	6.4	1.7	1.5	5.3	6.2	0.7	6.6	9.1	5.8	0.9
	HD3	4	31.3	4.9	6.4	2.8	2.6	4.8	0.6	6.7	2.2	1.7	5.5	5.5	0.6	5.6	8.8	6.3	1.4
	HD4	5	34.8	4.1	5.3	3.3	3.1	4.6	0.5	7.1	2.3	1.9	6.3	4.9	0.6	6.4	7.9	6.6	0.8
	HD5	7	35.7	3.8	7.1	3.7	3.5	5.4	0.6	7.4	1.9	1.8	6.7	6.6	-	6.6	7.6	6.8	0.8
	HD6	9	34.4	4.6	6.3	4.1	3.5	4.8	0.7	6.9	2.4	1.6	5.8	6.4	1.9	6.3	8.3	6.5	0.7
Range			31.3-35.7	3.8-5.4	5.3-7.1	2.8-4.1	2.3-3.5	4.6-5.4	0.5-0.7	6.4-7.4	1.3-2.4	1.3-1.9	5.3-6.7	4.9-6.6	0.6-1.9	5.6-6.9	7.6-9.1	5.7-6.8	0.7-1.8
Average			34.1	4.58	6.16	3.46	2.98	4.95	0.58	6.9	1.96	1.63	6	5.86	0.92	6.4	8.46	6.28	1.06

Opaques minerals

The percentage of this group in sediments reached between 32.8-38.5, 31.7-36.6, 34.9-38.6, and 31.3-35.7% of sites 1,2,3, and4 respectively at a rate of 36.175, 34.22, 36.8, and 34.1 of sites 1,2,3, and4 respectively (Table 1), the grains of these minerals have sub-rounded to sub-angular shapes and are brown to black (Plate 2).

Transparent Heavy Minerals

These heavy minerals can be classified according to their stability into three subgroups: Ultra-stable, Unstable and Metastable heavy minerals.

Ultra-stable heavy minerals

Tourmaline mineral

It is characterized by rounded to sub rounded shapes with a high relief and is characterized by the honey colour with pleochroism phenomenon which is a characteristic feature of the tourmaline. It is one of the minerals with high resistance to weathering processes (plate 3) and its percentage in the sediments of the study area is between 3.6-4.7, 3.5-5.1, 3.6-4.4, and 3.8-5.4 %of sites 1,2,3, and4 respectively and a rate of 4.22, 4.42, 3.98, and 4.58 of sites 1,2,3, and 4 respectively (Table 1).

Zircon mineral

Zircon is considered an ultra-stable mineral for its resistance to weathering processes, and it was identified in the study area as a prismatic form and changing its shape according to the alteration process. It is characterized by a high pint (plate 3), very high relief. It ranges between 5.4-7.7, 5.1-7.5,5.2-7.4, and 5.3-7.1 % of sites 1,2,3, and 4 respectively and a rate of 6.35,6.17,6.16, and 6.2 of sites 1,2,3, and 4 respectively (Table 1).

Rutile mineral

The amount of rutile is between 2.6-4.6, 2.3-4.8, 2.9-4.5, and 2.8-4.1% of sites 1,2,3, and 4 respectively with an average of 3.37, 3.7, 3.73 and 3.46 % of sites 1,2,3, and 4 respectively (Table 1). It is often painted with a red-brown colour (Plate 3).

Unstable Heavy Minerals

This group contains pyroxene and amphibole minerals.

Pyroxene group

A-Orthopyroxene mineral

It is white granules tilted to green and has parallel extinction and the phenomenon of pleochroism is clear in it (Plate 2), prismatic habit and its percentage ranges between 2.0-2.4, 2.4-3.2, 2.9-3.8, and 2.3-3.5 % respectively, and a rate of 2.27, 2.85, 3.26, and 2.98 respectively (Table 1), and the highest percentage is recorded in the sample HC5 (3.8%) in site three and the lowest percentage in the sample HA2 (2%) in site two.

B-Clinopyroxene mineral

Its granules are characterized by high relief, green color being opaque, and with an indistinct color due to the iron present above them, and have prismatic or irregular shapes, and sometimes angular, which reflect the effect of weathering (Plate 3). The percentage of these minerals in the study area ranges between 4.7-5.4,2.7-5.8,3.8-5.5, and 4.6-5.4% of sites 1,2,3, and 4 respectively with a rate of 5.05, 4,25,4.65, and 4.95 respectively of sites 1,2,3, and 4 respectively (Table 1) and the highest percentage of these are recorded in site two (5.8%) in depth 4m. and the lowest percentage in site two (2.7%) in depth 4m.

2- Amphibole group

The most important mineral that was identified in the study area is the Hornblende and Glaucophane, the Hornblende whose grains are characterized by longitudinal or prismatic shapes, with a green color (plate 1), and its percentage ranges between 6.4-8.4, 5.7-7.4,6.4-7.8, and 6.4-7.4% of sites 1,2,3, and 4 respectively and a rate of 7.175, 6.75, 7.05, and 6.9 of sites 1,2,3, and 4 respectively (Table 1), while Glaucophane characterized by high relief, prismatic habit, and with blue green colour mineral (plate 2), and its percentage ranges between 1.2-1.5, 0.6-0.9, 0.7-2.0, and 0.5-0.7% of sites 1,2,3,and 4 respectively (Table 1), and a rate of 1.35,0.75,1.02, and 0.58% of sites 1, 2, 3,and 4 respectively. The highest percentage of hornblende mineral was in the site one (8.4%) in depth 3m, while the lowest value was in the site two (5.7%) in depth 0.5m.

Epidote mineral

Is characterized by a sub rounded to angular shape, yellowish color, and it is not clear in some samples as its grains are covered with iron (plate 2). Its percentage in the study area ranges between 5.5-6.5, 4.6-6.4, 4.7-6.4, and 4.9-6.6% of sites 1, 2,3, and 4 respectively, and a rate of 6, 5.65,5.63, and 5.86 of sites 1, 2,3, and 4 respectively (Table 1).

Garnet mineral

The mineral grains are colorless, high relief, and sub-rounded shape (plate 2) with a percentage in the study area between 3.7-5.4, 4.4-5.4,4.2-5.7, and 5.3-6.7% of sites 1,2,3, and 4 respectively (Table 2) with a rate of 4.7,4.675,9,4.95, and 6 of sites 1,2,3, and 4 respectively (Table 1).

Celestite mineral

This mineral is present in small proportions in the samples of the study area and it characterized by an elongated habit form, colorless and with a pointed edge in one of its sides and is euhedral (plate 3), the rate of its percentage in the sediments of the study area was between 0.9-1.2, 0.6-1.5, 0.4-1.3, and 0.6-1.9 % of sites 1,2,3, and 4 respectively (Table 1) at a rate of 1, 1.05, 0.95, and 0.92 of sites 1,2,3, and 4 respectively (Table 1).

Staurolite mineral

It is found in a small percentage in the sediments of the study area, and it characterized by a high relief, yellowish color (plate 3) and ranges between 1.4-2.4, 1.4-2.1, 1.9-3.3, and 1.3-1.2.4% of sites 1,2,3, and 4 respectively (Table 1) at a rate of 1.825, 1.75, 2.46, and 1.96 of sites 1,2,3, and 4 respectively (Table 1).

Biotite mineral

This mineral was distinguished with lamellar shapes containing elongation, angular grains, and a light brown color (plate 1). The percentages ranges for this mineral between 4.9-6.1, 5.7-7.2, 4.8-6.8, and 5.7-6.8% of sites 1,2,3, and 4 respectively (Table 1), with a rate of 5.5,6.47, 5.85, and 6.28 of sites 1,2,3, and 4 respectively (Table 1).

Muscovite mineral

Muscovite was recorded in study area ranged between 4.5-7.4, 5.4-8.1, 5.3-7.7, and 5.6-6.9% of sites 1,2,3, and 4 respectively (Table 1) with a rate of 6, 6.52, 6.53, and 6.4 of sites 1,2,3, and 4 respectively (Table 1) the highest was 8.1% in site two at depth 4m, and lowest value was in site one (4.5%) at depth 3m (Table 1). Muscovite was flaky form, colorless angular to irregular out line (plate 1).

Chlorite mineral

This mineral is distinguished by its rounded and sub-rounded, sheets or flakes shapes and with green to altered colors (plate 1). The ranges of this mineral in the study area reached between 7.4-9.6, 7.9-9.2, 7.4-8.7, and 7.6-9.1% of sites 1,2,3, and 4 respectively (Table 1) with a rate of 8.45, 8.35, 8,06, and 8.46 of sites 1,2,3, and 4 respectively (Table 1).

Kyanite mineral

This mineral was identified in the samples of the study area, and this mineral takes longitudinal, angular and colorless (plate 1) the ranges of this mineral in the sites sediments reached between 1.2-1.8, 1.5-2.2, 1.6-2.2, and 1.3-1.9 % of sites 1, 2, 3, and 4 respectively (Table 1) with a rate of 1.47, 1.9, 1.86, and 1.63 of sites 1, 2, 3, and 4 respectively (Table 1).

Discussion

The heavy minerals in the study area are of a wide variety, which indicates the participation of more than one source of these minerals. It can be concluded that the source of these minerals are mainly igneous rocks, metamorphic rocks and other sedimentary rocks that are reworking in the second degree. [11] The presence of oxides Iron, the minerals hornblende, pyroxene and chlorite indicate that their source is basic igneous rock whereas; the presence of Epidote, granite and iron oxides indicates the origin of the alteration [12,13]. For the sedimentary origin, it is inferred from the presence of ultra-stable minerals and opaque minerals, which have the ability to survive several sedimentary cycles when old sediments are reworking to form new sediments [14,15].

The second proportion was chlorite minerals. The source of it is close, and the presence of these two chlorite and opaque minerals indicates the occurrence of a rapid erosion process.
For Epidote, its source could belong to the Tigris and Euphrates Rivers, and this is consistent with the study of [16], and that there is a high percentage of these minerals in the Tigris and Euphrates sediments. [17] And [18] explained that the percentage of Epidote mineral is high in the ancient deposits of the two rivers compared to modern deposits.

The percentage of Epidote mineral in this study is much less than that recorded by [18], when studying the Tigris and Euphrates Rivers, which amounted to 24%, that the group of Epidote is of medium stability minerals, so it shows signs on its surface resulting from the processes of abrasion and transport such as meanders and granules [11]. Epidote is found in metamorphic rocks [19].

The source of the Celestite mineral is local sedimentary environments and it is found in rocks such as calcareous and dolomitic [20], and the presence of the mineral Celestite reflects the conditions of the dry climate and the degree of intense evaporation [21]. Celestite mineral may be deposited in the study area due to the availability of suitable conditions for its formation.

Staurolite mineral is found in metamorphic rocks and is also common in sedimentary rocks in the form of a detrital mineral [13]. The mica group that was found in the study area represented in the minerals muscovite, chlorite and biotite formed a small percentage compared to what was found by [18] and [16], whose percentage ranges between 8-15%, and the current percentage of the study area reached 6.03-8.32% of heavy minerals. The environment of the study area may be slightly saline. Chlorite mineral is mainly produced from the alteration of other minerals such as pyroxene, amphibole and biotite [22]. Metamorphic rocks and green-schist rocks are also important sources of this mineral.

Ultrastable minerals, represented by zircon and tourmaline, were also found at a rate similar to that found [16], which ranges from 2-5%. As for the study [16] when studying the distribution of heavy minerals in the southern part of the Shatt al-Arab River, the opaque minerals ranged between 60-75%, unstable minerals 15-20%, mica minerals of 10-15%, and ultra-stable minerals 2-5%. As the presence of ultra-stable mineral tourmaline and a section of the opaque minerals with rounded shapes indicates that these are minerals have undergone more than one sedimentary cycle.

With reference to [23], the mineral chlorite identified in sediments is one of the minerals processed in modern sediments of the sedimentary plain by Rivers. The unstable minerals are the minerals pyroxene and the hornblende, whose presence indicates the occurrence of rapid erosion processes of the exposed rocks in the north and northeastern regions of Iraq, in one sedimentary cycle. The ancient climate of the source region was dry or semi-arid, which indicates that mechanical weathering is prevalent due to the lack of resistance of these minerals to chemical weathering. Therefore, these minerals are among the most affected by intrastriatal solution as it was shown [24], which is attributed to the large and exposed surface contribution of these minerals because they are often present in prismatic forms, as most of the effect occurs along the splitting lines, and this phenomenon is good evidence of the mechanical denudation of these minerals.

By relying on [25] classification, which links the content of heavy minerals and the stability of clastic sediments, where the studied samples were dropped, and because they contain a high percentage of opaque minerals in all samples as well as a high percentage of stable minerals, therefore, the studied samples are considered medium stability and close to being highly stable (Fig. 6).This indicates that the sediments of the studied area could be the products of a long time of transport and the interference of mutable forces. Because of the long transportation distance and weathering processes, there are many types of rocks, such as dunite and pyroxinite, which carry heavy minerals [26,28]. [29] Indicated that the presence of Ultra stable heavy minerals such as Tourmaline, Zircon and Rutile are evidence that the source rocks that carry these minerals are not close and have a high resistance to weathering processes.

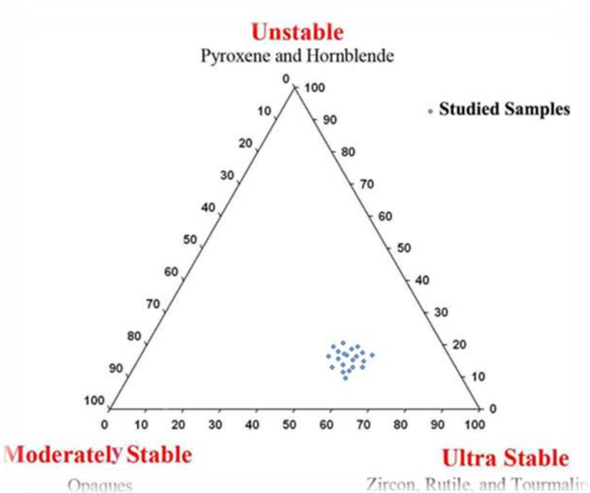


Fig. 6. Triangular chart for the stability of heavy minerals according to Kasper-Zubillaga *et al* (2008).

Conclusion

The grains of the heavy minerals in the study area are angular to sub- angular which could reflect the diversity of the source rocks. Ultra-stable heavy minerals present in rounded grains which could show that the grains have gone through more than one sedimentary cycle. Also, the abundance of unstable heavy mineral grains in angular shape could give evidence that the area of origin from which the sediments were derived is characterized by the predominance of mechanical weathering processes and the climate of the region was dry to semi- arid.

Reference

1. Buday, T. And Jassim, S-Z. , (1987). The Regional Geology Of Iraq, Tectonism , Magatism , Metamorphism , Geol . Surv. Min. Investing.

2. Mahmoud R.A., (2002). Evidence of the Geometric Stratigraphic Succession of Quaternary Sediments in Basrah City, NCCLR, Basrah.

3. Master, S., (2002). Umm Al Binni Lake, A possible Holocene Impact Structure in Marshes of Southern Iraq: Geological Evidence For Its Age And Implications Of Bronze Age Mesopotamia, School Of Geosciences, Johannesburg.

4. Aqrawi, A.M, (2001). Stratigraphic Signature Of Climatic Change during The Holocene Evolution Of The Tigris – Euphrates Delta ,Lower Mesopotamia, Global and Planetary Change 28, 267-283.

5. Aqrawi, A.M, (1995). Correction of Holocene Sedimentation Rates for Mechanical Compaction: Tigris – Euphrates Delta, Lower Mesopotamia, Marine &Petroleum Geology, 12, (4), 409-416.

6. Silva, M. and vital, H., (2000). Provenance of heavy minerals in the piranhas – Acu river northeastern Brazil, Report, 30 (3) 453-456.

7. Mushrif, Mohamed Abdel Ghani, (1997). Foundations of Sedimentology, King Saud University, 592 p.

8. Friedman, G.M., and sanders, J. E., (1978). Principles of sedimentology, New York, Wieley and sons, 292P.

9. Morton, A.C.; Knox, R.W. and Hallsworth, C.R., (2002). Correlation of reservoir sandstones Using quantitative heavy minerals analysis . Petroleum geosciences. 8, 251-262.

10. Hubert, J. F. , (1962). Azircon- Tourmaline – Rutile maturity index and the interdeependence to the composition of heavy minerals assemblages with the gross composition and texture of sandstones. Jour. Sed. Petrology. 32, 440-450.

11. Folk. R. L., (1974). Petrology of Sedimentary Rocks. Hemphill Pub. Co. Texas, USA, 128P.

12. James, R., (1984). Exploration for industrial minerals in Mississippi sound and adjacent offshore territories of Mississippi and Alabama. Mississippi Mineral Resources. University of Mississippi, 11, 19-83.

13. Mason, B. and Berry, L.G., (1968). Elements of mineralogy. John Wiley, New York, 463P.

14. Pettijon, F.; Potter,P.E. and siever, R. , (1973). Sand and sandstones. Springer- Verlag, New York, 618P.

15. Edit, T., Magyari, A., Nagy, A, Unger, Z., and Kercsmar, Z., (2007). OSI data and heavy minerals analysis of upper quaternary sediments from the valleys of the EeR and Berettyo rivers. Geochronometria, 28, 17-23.

16. Albadran, B.; Al-Beyati, F. and Abdullah, Y., (1996). Heavy minerals distribution in the lower part of the shatt al-Arab rivers S. Iraq marina Mesopotamia, 11(1), 17-26.

17. Al-Ali, A.J., (1976). Heavy mineral provinces of the recent sediments of the Euphrates – Tigris basin .Journal of geological, society Iraq, X, 33- 46.

18. Philip, G., (1968). Mineralogy of recent sediments of Tigris and Euphrates river and some of older detrital deposits. 38(1), 35-44.

19. Admin, A., (1999). Depositional environments and provenance of the Wajid Sandstone, Abha-Khamis Mushayt area, Southwestern Saudi Arabia. Master's thesis, King Fahd University of Petroleum and Minerals.(WWW. Depositional environments.com).

20. Heinrich, E. Wm., (1965). Microscopic identification of minerals. Mc Graw-Hill Book Company, 413p.

21. Semaan, Sabah Yousef, (1986). Mineral and Geochemical Salt Salt - Samawah - Southern Iraq. Unpublished Master's Thesis - University of Basrah - 148 p.

22. Hatch, F.H.; wells, A.K. and wells, M.K., (1974). Petrology of the Igneous Rocks; Thomas Muby and Co., 551P.

23. Aqrawi, A.A. M., (1993). Palygorskite in the recent fluvoi- Lacustine and deltaic sediments of southern Mesopotamia, Research of clay minerals, 28, 153-159.

24. Witham, A. G.; Morton, A. C. and Fanning, C.M., (2004). In sights into cretaceous – paleogene sediments transport paths from aheavy mineral study of sand stones from southern east Gree land. Pet. Geosciences, 10, 61-72.

25. Kasper-Zubillaga, J.J., Dickinson, W.W., Carranza Edwards, A., and Hornelas-Orozco, Y., (2008). Petrography of Quartz Grains in Beach and Dune Sands of Northland, North Island, New Zealand. NZ J. Geol. Geophys. 48, 649-660.

26. Alsamaani, J. J., (2011). Mineralogy and geochemistry of sandstone of al-mukdadiya formation in selected areas, north- eastern Maysan. Unpublished Master's Thesis - University of Basrah - 117 p.

27. Al-Najjari, N. A. and Al-Khafaji, S. K., (2019). Heavy Mineral Study of Injana Formation in Selected Area in Northern Iraq and Eastern Iraq. Journal of Scientific and Engineering Research, 6(8):206-213.

28. AL- Kaaby, L. F. and Albadran, B. N., (2020). Minerals and sedimentary characteristics of quaternary sediments of different regions in southern Iraq. Iraqi Geological Journal, Vol.53, No.1A.

29. Abas, N. S., Albadran, B. N., and AlWhaely, U., Q., (2019). Heavy Minerals Distribution and Provenance in Palinurus Shoal, Northwest of the Arabian Gulf. Basrah Journal of Science, Vol. (1), 113-125.

Samarra Journal of Pure and Applied Science

www.sjpas.com

p ISSN: 2663-7405
e ISSN: 2789-6838

توزيع المعادن الثقيلة في جنوب هور الحمّار، جنوب بلاد ما بين النهرين

خليل جبار السوداني[1]*، بدر نعمة البدران[2]، ليفيو جيوسان[3]
1 قسم الجيولوجي، كلية العلوم، جامعة البصرة، البصرة، العراق
2 جامعة المعقل، البصرة، العراق
3 معهد وودز هول لعلوم المحيطات/الولايات المتحدة الامريكية

https://doi.org/10.54153/sjpas.2022.v4i1.335

معلومات البحث:

تأريخ الاستلام:2021/12/08
تأريخ القبــول: 2022/01/16

الكلمات المفتاحية:

بتروغرافي ، معادن ثقيلة، هور الحمار، بلاد ما بين النهرين.

معلومات المؤلف

الايميل
الموبايل:

الخلاصة:

تم اختيار أربعة مواقع جنوب هور الحمار الجزء الجنوبي من بلاد ما بين النهرين وتم حفرها على أعماق مختلفة. الموقع الأول على عمق 2 م والموقع الثاني 4 م والموقع الثالث والرابع 9 م. أظهرت نتائج تحاليل المعادن الثقيلة أنواعا مختلفة، حيث سيطرت المعادن المعتمة بنسبة 35.15٪، تليها المعادن الشفافة، الكلوريت، الهورنبلند، المسكوفيت، الزركون، البيوتايت، والإبيدوت. يشير الشكل الثلاثي إلى أن العينات المدروسة تعتبر متوسطة الثبات وقريبة من العالية الاستقرار. تميزت رواسب منطقة الدراسة بوجود معادن مستقرة لاحتوائها على نسبة عالية من المعادن غير الشفافة بالإضافة إلى نسبة عالية من المعادن فائقة الثبات. الجزء الأكبر من رواسب منطقة الدراسة ناتج عن تجوية الصخور من المناطق المرتفعة في دورة واحدة وعملية النقل السريع التي تقلل من تأثير التجوية والذي يستدل عليه من وجود معادن غير مستقرة في الرواسب وذلك إن وجود معادن غير مستقرة مثل الهورنبلند والبيروكسين دليل على أن منطقة المنشأ ذات مناخ جاف أو شبه جاف ، مما يعني أن التجوية الميكانيكية للصخور الأصلية أكثر فعالية من التجوية الكيميائية.