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SYNOPSIS OF STRATIGRAPHIC TERMS IN PALESTINIAN GEOLOGY.[1]

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A.

Abu Hareira sandstone name given by Picard and Solomonica (1936, p. 204) for a hard crossbedded, occasionally glauconitic, sandstone of Middle Pliocene (Astian) age. It was described for the first time by Hull (1885) from Tell Abu Hareira in Wadi-Sheria in the Gaza district as part of Hull's "*Calcareous sandstone of Philistaea*".

Actaeonellenkalk (Blankenhorn 1914). Type fossil *Act. salomonis*. Fraas correlates the mizzi helu (Turonian) Limestone. Not (vide mizzi helu) identical with the Acteonella flint beds (Picard).

Acteonella flint beds. The name given by Picard (1938, p. 7, 8) correlates the "kieselige Schneckenbank" of Fraas. The zone is characterised in the Judean mountains by limp-shaped flint concretions with entirely silicified *Acteonella* and *Nerinea (Trochacteon salomonis* Fraas and *Nerinea requieniana* d'Orbigny). The thin beds are interstratified in the Mizzi helu and are of Turonian age.

Argille a Corbula eretzisraelensis Shalem. Name introduced by Shalem (1925, p. 162–164; 1927, p. 176; 1928, p. 69–108) representing a relatively thin layer (5 meters) of green marl and clay "argille verde di Gerusalemme" in the neighbourhood of Jerusalem.

Shalem placed this horizon between his *Calcare a Pterodonta deffisi* and the *Calcare inferiore a radioliti.* The strata gives rise to springs in different parts of the country (Engedi, Carmel, Judean highlands) (Picard 1933).

[1] The present "Synopsis" was originally prepared for the "Lexicon International de Stratigraphie" Volume "Asia" some years ago. As it is unlikely that this volume will appear in the near future and as geologists and non-geologists have asked for such a synopsis in order to facilitate their reading of Palestinian geological literature I decided to take the opportunity of publication in *JPOS.* Save two uncertain definitions, "Emscherstufe" and "Grundgebirge", no international stratigraphic terms have been included in our synopsis.

They are identical with the *Mozamarl* of Picard (1938, p. 3), who put it at the base of the Upper Cenomanian.

Asphalt Kalke (calcaire asphaltique de Nebi Musa) vide Hajar Musa.

B.

Basaltlava of Tiberias, trap of Tubariya, Auronitic and Trachonitic basalts-so named by Anderson (Lynch 1852, p. 124) for the large basalt area of Galilea, Hauran, Jolan and Ajloun. These volcanic rocks were observed since olden times and were described by many explorers from Burkhardt (1822) to the latest description given by Dubertret (1929) for the Hauran, and Picard (1929, 1932) for Southern Galilee. Age of eruption between Pliocene and Pleistocene. Lartet's "*Mimosite*" (1869, p. 68) from Kerak in southern Transjordan belongs to a series of similar basalt trap. Cretaceous Basalt and Basalt-Tufa have been discovered by Blanckenhorn in the Mountain of Carmel and described by Fuchs (1915, p. 570) [vide also Blake 1936.]

Basislehme A. Picard (1932, p. 223). This strata lies unconformable between Pliocene (*Melanopsisstufe*) and Old Pleistocene *Naharaimschotter*), aged as "Frühdiluvium" and representing a terrestrial period of terra rossa-weathering, before the appearance of Pluvial A in the Jordan Valley.

Besanterrace vide Kalksinter von Besan.

Bet-Jibrin series term recently introduced by Picard und Solomonica (1936, p. 194) and regarded by them as of Upper Eocene-Oligocene for a series of compact, fine-grained, chalky limestone, poor in fossils, characteristic of the neighbourhood of Beit-Jibrin (Hebron District). Avnimelech (1936, p. 89) put the "craie de Jibrin" on a par with the Lower Eocene "*couches de Sara*" whereas the I.P.C. geologists Wellings and Daniels seem to consider it as Middle-Upper Eocene (Blake 1936, p. 29).

Bituminous Limestone of Nebi Musa vide Hajar Musa.

Blauton der Haifa-Bucht—named by Picard (1931a, p. 169) for the blue clay, underlying the recent dunes and the chamra of the Haifa-plain. The horizon is 2–3 meters thick and rich in marine shells of recent type. Age: Lower Holocene (Recent to Upper Pleistocene.

"*Buchiceras Stufe*" vide *Zone des Ammonites syriacus.*

C.

Chamra, Ḥamra — Arabic name for a reddish brown, sometimes sandy loam partly identical with the Mediterranean type of recent and fossil "terra rossa" (For Literature vide Reifenberg, 1929; Blanck, 1930; Picard-Avnimelech 1937).

Calcaire ou *couches à Leda* (Lartet 1869, p. 173) corresponds with Anderson's (Lynch 1852, p. 162) "*fossiliferous chalk of Mar Saba*". Both authors had in mind the soft chalky limestone of Senonian (Maestrichtian-Campanian) age covering a part of the Judean Desert. As Leda more frequently occurs in the Campanian, possibly only these beds have been considered as *couches à Leda.*

Calcareous sandstone of Philistia named by Hull (1886, p. 63) and dated by him as Upper Eocene, corresponding probably to the Lithothamnienkalke of Blanckenhorn. Vide *Lithothamnienkalke.* Picard, who compared (1931a, p. 168; 1936, p. 104) this calcareous sandstone with that occuring in the Carmel and Galilea applied for a Pliocene (Astian) age. Hull may however have included in this horizon calcareous sandstone beds of similar facies but of Quaternary age. The formation is rich in *Miliolidae* and *Algae.* It is found along the ridge of the coastal mountains from the Plain of Beersheba until Carmel, there entering into the plain of Esdraelon. (vide Abu Hareira sandstone).

Calcare superiori a Radioliti. Name given by Shalem (1924, p. 180) for three different horizons: *Mizzi jahudi*, *Meleke* and *Mizzi helu* of the neighbourhood of Jerusalem which belong partly to Upper Cenomanian, and partly supposed to be Turonian.

Calcare inferiori a Radioliti named by Shalem (1927, p. 174) for two zones: *calcare a Nerinea cochleaeformis* and *Cerithium elias* in the neighbourhood of Jerusalem. These dolomitic series mostly of Lower Cenomanian age correspond with the dolomitic cliffs of the Carmel (N. W. border) and Engedi (Dead Sea W-side).

(Marne e) *Calcare ammonitiferi.* Name given by Shalem (1925, p. 165; 1927, p. 178) for Upper Cenomanian, calcareous and marly beds rich mainly in *Acanthoceras* (*Acanthoceras mantelli* Schl., *Ac. palestinense* Blanckenhorn), *Cardium*, *Hemiaster* and *Pecten.* Only this horizon should be considered as Zone of *Acanth. palestinense* et *rhotomagense* of Blanckenhorn (1905, p. 80) or Shalem's *rhotomagiano*

that underlies the *Deir jasini* and correlates the "*Zone of the fossiliferous marly limestone*", recently termed by Picard (1938, p. 5).

Calcare a Pterodonta deffisi name given by Shalem (1925, p. 164) and placed between the zone of Acanthoceras and *argille a Corbula eretzisraelensis* of this author (vide *argille a Corbula*). The *Pterodonta* beds may already belong to the Upper Cenomanian. It is however not certain how far this horizon includes the *Mozamarl.* (vide discussion Picard 1938, p. 4).

Calcare a Nerinea cochleaeformis. Upper division of Shalem's *calcare inferiori a Radioliti* (1927, p. 174) can be regarded as of Lower Cenomanian age. These beds which besides *N. cochleaeformis* contain big *Strombidae* are represented as thick series of dolomites and dolomitic limestone with concretions of flint and quartz.

Calcare a Cerithium elias. Named by Shalem (1925, p. 160; 1924, p. 174) for his lower division of *Calcare inferiori a Radioliti.* These beds are again developed in the neighbourhood of Jerusalem in dolomitic facies. As *Cerithium elias* is found throughout the Cenomanian the exact stratigraphic position of these beds remains unsettled; they belong most likely to the Lower Cenomanian.

Chalk flint series, vide *Feuersteinführende Kalke*

Couches de Sara, vide *Sarabeds.*

D.

Der jasini. Name introduced by Blanckenhorn (1905, p. 83) for thin and well bedded limestone beds characterised by its red striped colours and by its richness in fish remains. Blanckenhorn therefore regards the Der jasini as correlating with the fish-beds of Hackel of the Syrian Cenomanian. The Der jasini is a local Cenomanian facies which Blanckenhorn generally referred to in his "*Untere Mizzi*" but it has been arranged more accurately by Shalem (Der jassinico, 1927, p. 179) as an intermediate strata lying between Mizzi jahudi (Upper Cenomanian) and the zone of Acanthoceras rhotomagensis (Middle Cenomanian). The name is derived from the village of Deir Jasin in the vicinity of Jerusalem where these beds occur. The "Der jasini laminated limestone" was recently discussed by Picard (1938, p. 5).

Dépôts de la Liçan, dépôts des *marnes de la Liçan* or *ancient dépôts de la Mer Morte.* Names introduced by Lartet (1869, p. 239,

245) for a very fine stratified series of calcareous and gypseous marl which represents the deposits of a pleistocene lake. This lake once extended over a large part of the Jordan valley from the Sea of Tiberias in the north until the region, south of the Dead Sea (Hulls "*Ancient deposits of the Salt Sea*" 1886 geol. map).

Blanckenhorn regards his "*Lisanmergel*" to be Lower Diluvium (1931, p. 38; 1914, p. 39). They correspond to Hull's Pluvial epoch or Blanckenhorn "großes Pluvial" (1914, p. 53).

Picard in an earlier conception (1932, p. 191, 227) referred the Lisanmarl to the Middle and Younger Pleistocene (his "Pluvial B.") but more recently (1937 b, p. 69) refers the "Lisanstage" also to the whole Pleistocene (Pluvial A-B).

Dunes, Dünen (Hulls 1886, p. 88, sand hills of the maritime coast). Range (1921, p. 203; 1932. 51), Löwengart (1928, p. 505) and recently Picard and Solomonica (1936) distinguish older or Pleistocene and younger or recent dunes in the coastal plain, however, an exact chronology is still missing, although more facts and a better elucidation of the origin of these dunes were brought forward in Picard and Avnimelech 1937.

Desert sandstone (Hull), vide *Nubian Sandstone* and *Wadi Nasb Limestone.*

E.

Emscherstufe: Taubenhaus (1920, p. 50) tried to introduce the Emscherstufe as a stage between Turonian and Senonian. His investigation was based on various collections of ammonites brought from Palestine and Transjordania. But the material, which came from different strata (Cenomanian and Senonian) and localities has been erroneously placed together. It is doubtful whether the Emscherstufe is at all represented in Palestine as such.

Escarpment clays named by Wellings, Daniel and Damesin (in Blake 1936, p. 5) for a brown sandy loam representing the uppermost layers in the Gaza district. According to Blake they contain 21–23% $CaCO_3$, are about 17 m thick and of Pleistocene age. The escarpment clays apparently correlated to the old dunes in a state of far going decomposition as described by Picard and Solomonica (1936, p. 214).

F.

Feuerstein-führende Kalke of the Mount of Carmel, which Noetling (1886, p. 847) regarded as Upper Senonian has been placed by Picard (1928, p. 38) as Feuersteinkalke into the Upper Cenomanian (or Turonian?). Blake (1936, p. 56) follows this classification including the underlying chalky limestone in one series: Upper Cenomanian Chalk-flint series. To this zone one may attribute Vroman's *flinty limestone.*

The friable chalk of the upper strata. Name used by Anderson (1852, p. 162) for strata belonging to the Upper part of the Senonian, might be identical with the "mottled zone" (Danian?).

"*Flammkalke*" vide *Kaʿkuhle.*

G.

Grundgebirge. Blanckenhorn (1914, p. 10–12) compiled with this word series of igneous and volcanic rocks of Archaic and Praecambrian age, which have been found and partly described by Lartet, Hull (v. Rudler), Blanckenhorn (For literature vide: Blanckenhorn 1914). The rocks are divided into two large groups: 1. Granite and cristalline shists (granite, gneiss) from the East side of Wadi el Araba and Wadi el Akabah. 2. Older eruptive rocks such as Porphyry, Porphyrite, Diorite, Diabas, Gabbro from the Wadi el Araba. Among the Porphyritic rocks are distinguished: Diorite, Porphyrite, Felsite Porphyry, Quarz Porphyry, Porphyry Tufa. Andesits of Hull's (1886, p. 139) collection from Jebel esh Shomrah has never since been recorded. Reference is to be made to some Granitite, Quartzdiorite, Alkaligranite of Kober's collection from the neighbourhood of Akabah and described by L. Waldmann (1926, p. 31). The most recent description of similar rocks from this area is given in Blake (1936, p. 79 ff.).

Glandarienzone (-Kalk). Named by Fraas (1878, p. 22) for limestone and marl beds from the Lebanon containing numerous spiculae of *Cidaris glandaria* Lang. This horizon had already been known to Russegger (1847, p. 249) as Cidariten-Kalk and had been regarded by him, as by other authors, to be of Jurassic age. Fraas considered this zone to be Cenomanian. Van Ingen (1905, p. 357) described *Cidaris glandaria* brought from the Wadi ez Zerka or Jabbok

in Transjordania. Blanckenhorn (1912, p. 305), however, assumed an error in the determination or labelling of van Ingen's collection. But since Cox (1925, p. 170) published a typical Bajocian-Bathonian fauna from the same region there is reason to believe van Ingen's statement, although remains of *Cidaris glandaria* itself have not been recorded again from this area. The zone of Glandaria is generally regarded as of Oxfordian-Kimmerian age.

Großes oder *Hauptpluvial* (Blankenhorn): vide *Dépôts de la Liçan.*

Grès de Petra: vide *Nubian Sandstone.*

(Lower and Upper) *Gravel Horizons.* Picard and Avnimelech (1937, p. 266 ff.) distinguish in the Pleistocene of the Coastal Plain an Upper and Lower gravel horizon (series) of terrestric origin. Accordingly they may represent two Pluvial stages (A,B). Similar gravels have been recorded by Löwengart 1928.

H.

Untere Hippuritengruppe, named by Fraas (1867, p. 57), correlates with the "*Meleke*" of the Lower Turonian (vide the most recent classification in Picard 1938) from the neighbourhood of Jerusalem.

Obere Hippuritengruppe of Fraas (1867, p. 53) correlates with "*Mizzi helu*" (Turonian) of the Jerusalem district.

"*Hajar Musa*" (Moses-stone). A popular name given for a black bituminous limestone located around Nebi Musa, an Arab place of pilgrimage in the Judean desert (SW. of Jericho). It is recorded already in the earliest description of Palestinian explorers such as Burkhardt (1822), Seetzen (1810), Russegger (1847). These are the calcaire asphaltique de Nebi Musa or "pierre de la mer morte" of Lartet (1869, p. 171). They correlate with Blanckenhorn's (1905, 1914 etc.) Stinkkalke or Asphaltkalke or Bitumenkalke which this author formerly (1905, p. 116) placed in the Campanian and later (1914, p. 27; 1915, p. 187) in the Danian on account of *Pecten obrutus* Conrad which, however, is also found in the Maestrichtian of Egypt. According to Picard (1931, p. 17) in the Judean Highlands there must be distinguished three bituminous layers of which two belong to the Campanian and Maestrichtian and of which the third or uppermost bituminous horizon represents the limestone of Nebi Musa, referred with reservation to the Danian (?).

Hangendlehme b. Name provisionally given by Picard (1932, p.

223) for a reddish loamy bed representing an Interpluvial stage or Eluvial epoch in the Pleistocene of the Jordan valley. The strata are interbedded between "*Naharaimschotter*" (Old Pleistocene) and "*Samadschotter*" (Middle Pleistocene).

Hauptterrasse of the Jordan Valley, Hauptseeterrasse of Jericho, named by Blanckenhorn for the flat plain which is more generally known as the plain of the Jordan Valley. The underground consists in most parts of "Lisanmarl" (dépôts de la Liçan)—the deposits of a diluvial Jordan lake. Blanckenhorn dated the main terrace as Old Diluvium. Picard's conception (1932, p. 197), however, is that these "sea terraces" originated during the Younger Pleistocene. The Hauptterrasse corresponds to Anderson's (1852, p. 140) "Upper Terrace" near Beisan or Hull's (1886, p. 98) "Old Lake Terrace" of the Jordan-Arabah Valley. The extension of the main terrace therefore correlated the distribution of the "dépôts de la Liçan".

J.

Jajurfacies named by Picard and Solomonica (1936, p. 208, 212) for rocks consisting of a white coarse limestone with many fossil-casts of Gastropodes, Bivalves and Coralls, occasionally intercalated with pebbles of limestone and flint (Cretaceous-Eocene) indicating the old coast line. It was first discovered by Picard and later described (Blanckenhorn-Oppenheim 1927, Picard 1928) as Middle Pliocene from the Northern Carmel border near Yajur [sometimes written "Jadjur", and recently recorded near Beersheba] (Blake 1936, Picard and Solomonica 1936). Picard and Solomonica consider the Yajurfacies as the lower part of the Astian-stage.

Jebel Usdum Series vide *Usdum series*

Juragruppe vide *Untere Juragruppe.*

Jibrinfacies, Jibrinseries vide *Beth Jibrin series.*

K.

Kaʿakuhle. Arabic name for a semi- hard, white limestone of the Jerusalem district first introduced by Fraas (1867, p. 58 "Kakuleh") for his "milder Kreidekalk". In the Galilee (North part of Palestine) a similar limestone is called "Sultaneh". Originally divided by Blanckenhorn (1905, p. 101, 110) in "untere Kakuhle" or Santonian and "obere Kakuhle" or Campanian the name Kakuhle has later

been used by him only for the beds of the Santonian age. The reddish striped colouring which often occurs in the rock has been regarded as typical of the Santonian horizon. Picard (1931, p. 10) however, observed these "Flammkalke" too in Campanian and Maestrichtian beds. Without any remarkable change of facies the Kaʿakuhle limestone of Santonian age passes into the Campanian. Also the Ammonites of both horizons (*Schloenbachia, Mortoniceras*) have hitherto not allowed for a clear separation of Campanian and Santonian. Kaʿakuhle, therefore, should be regarded according to the older conception as representing both Campanian and Santonian. The real Kaʿakuhle contains always some siliceous matter. (Picard 1938, p. 8).

Kalksinter von Besan — so named by Picard (1929, p. 31) for the terrace on which is situated the town of Beisan, near the Jordan Valley. It consists of 20–40 m of calcareous sinter, representing deposits of springs and rivers of Young Pleistocene-Holocene age. This terrace has been first described by Blanckenhorn (1907, p. 236).

Kieselige Schneckenbank (Fraas) vide *Acteonella flint beds.*

Kleinpluvial (Blanckenhorn) vide *Mittelterrasse.*

Koprolithenkalke (Blanckenhorn) vide *Phosphorittrümerkalke.*

Kurkar. Under this name is understood a diagenetic, hardened, calcareous sandstone of marine, or of terrestrial origin (older Dunes) distributed in the coastal plain. The name applied by Löwengart (1928, p. 504) has, therefore, no stratigraphic significance. It is mostly considered as of Pleistocene age, but its formation may take place even within recorded time. The incrustation of the Quaternary sand layers of the coastal plain by $CaCO_3$ solutions may be (1) analogous to the development of Nari in calcareous rocks of the mountain (see Nari) or (2) may be caused by circulation and redeposition of lime from groundwater rich in $CaCO_3$ similar to the process of cementation in ore deposits (Picard 1935).

Kornub-Hosb sandstone first recorded in Blake (1928, p. 22, 23, 27) for sandstone of terrestric origin. In other localities like Zuweira, et Tlah (first recorded by Blanckenhorn 1912, p. 140) the sandstone is occasionally intercalated with conglomerates. Blake compared these deposits with the Usdum series and like Blanckenhorn (1929, p. 140) suggested a Pliocene age. Recently Blake states that: (a) (1936, p. 6) the age "has not been determined" (b) (1936, p. 26)

"the Kornub series may be of Helvetian age". Picard and Solomonica suppose a Pontian age. The question of the age of the Kurnub series, however, remains unsolved and many of the above mentioned localities presumably belong to quite different periods and facies.

L.

Loess of Beersheba. A sandy loam discovered and described by Range (1921, p. 200–202). Distributed over the Gaza-Beersheba depression in the south of Palestine. Its age is probably the end of the Diluvium, but the finding of pottery in 200 B.C. shows that the loess was deposited also in historic times. Origin uncertain believed to be formed by strong desert winds (E, SE) (Range 1921) or partly by fluviatile redepositing of sandy, clayey Pliocene along wadi-depressions (Picard and Solomonica 1936, p. 217)

Lithothamnienkalke named by Blanckenhorn (1914, p. 37) for marine calcareous sandstone from the Wadi Ghaza (Ghazza, Raza, Gaza) and el Chalasa (Khalasa) in the south and considered by him to be Quaternary. The Lithothamnienkalke may correspond to Hull's "*Calcareous Sandstone of Philistia*" (1886, p. 63) which this author once regarded as Eocene. Recent investigations (Picard 1928a, Blake 1936, Picard and Solomonica 1936) suggest a Pliocene origin.

"*Lower strata of the cliff*" (Anderson) vide *Untere Juragruppe.*

M.

"*Lisanmergel, Lisanmarl, Lisanschichten, Lisanstufe*" vide *dépôts de la Liçan.*

"*Lower gravel horizon*" vide *Gravel horizon.*

Marnes de la Liçan (Lartet) vide *dépôts de la Liçan.*

Marne argillose vide *Argille a Corbula eretzisraelensis.*

Marne calcari ammonitiferi vide *calcari ammonitiferi.*

Marne argillose verdastre di En Giriut named by Shalem (1927, p. 71) for a thin bed of marl regarded as the base of the Cenomanian in the Judean mountains. The fauna may already belong to the Albian but has not, as yet, been accurately described.

Melanopsisstufe. Name introduced by Blanckenhorn for Upper Pliocene strata, rich in fossils of the *Melanopsis* group, discovered by this author in Northern Syria and described in 1897.

In 1907 Blanckenhorn found a similar fauna in connection with

disturbed strata south of Tiberias on the western side of the Jordan Valley (Jsr el Mujamie). In the Handb. der reg. Geol. 1914 (p. 38) Blanckenhorn placed the Melanopsis stage in the Diluvium. In 1931 (p. 31) he again indexed it in the Upper Pliocene. The fauna was described by Blanckenhorn in 1927. Picard recently (1932, p. 176, 1933) discussed the matter and on account of a rich, faunistic material and because of paleogeographic and tectonic reasons, he considers these beds to be of the Levantinian or Middle-Upper Pliocene age.

Meleke: (malaki) "The Royal". An Arabic name used for an excellent building- and tomb-stone from the vicinity of Jerusalem. Name as stratigraphic horizon introduced by Fraas (1867, p. 51) for strata underlying "Mizzi helu". It has been regarded (Blanckenhorn, 1905) as representing the Turonian or Uppermost Cenomanian. However, a similar marmorisated limestone has been found by Picard (1928, p. 36, 37) on Mount Carmel as well as in other parts of the country (Mozah, Ramallah) belonging to the Middle Cenomanian. Blake (1936, p. 56) distinguishes an Upper Cenomanian Rudist-Meleke series superincumbent on his chalk-flint series. "Meleke" should, therefore, be used only as "facies" name. Picard distinguishes (1938, p. 4, 7) in the Jerusalem area a "*Meleke of the Upper Cenomanian*" (lying above the Moza-marl) and a "*Meleke of the Turonian*" (between Mizzi ahmar and Mizzi helu). The latter he terms also "*Main Meleke horizon*".

Mimosite (Lartet) vide *Basalt Lava.*

Mittelterrasse named by Blanckenhorn (1914, p. 40, 59) as a representative of his "Kleinpluvial". This terrace, regarded as much younger than the "Hauptterrasse" of the same author, has been distinctly observed only on the Wadi slopes. It seems therefore more likely to be a river terrace and not a lake terrace. According to Picard's classification the Mittelterrasse may be developed during the Upper Pleistocene.

Mizzi (Mizzih, missi). The Arabic name mizzi "the excellent" first introduced by Fraas (1867, p. 53) for a building stone in the neighbourhood of Jerusalem. The mizzi of Fraas indicates a horizon which later has been regarded as *mizzi helu* of Turonian age in contrast to other mizzi stones of Cenomanian age.

Mizzi aḫdar (the green mizzi) vide *Phosphorittrümmerkalke.*

Mizzi aḫmar (the red mizzi) a local name used first by Blancken-

horn (1905) for a reddish variety of Upper Cenomanian dolomitic limestone overlying the *mizzi jahudi* of Jerusalem and underlying the *Meleke* (last discussion vide Picard 1938, p. 6.).

Mizzi helu (ḥilu) "the sweet or soft" or *Obere Mizzi.* Name introduced by Blanckenhorn (1905, p. 92) for white limestone, sometimes also called *mizzi abiad* "the white". Fraas named it Nerineenmarmor (1867, p. 53) because of the abundant occurrence of *Nerinea requieniana*, d'Orbigny, frequently found together with *Trochacteon salomonis*, Fraas. The beds further contain a concretionary, pseudoolithic limestone band or "Erbsenkalk". Overlying the Lower Turonian "Meleke" and covered by the Senonian "Kakuhle", the Mizzi helu has been considered as the main representative of the Turonian. Picard (1938, p. 7, 8) distinguishes two groups of Mizzi helu: "The Mizzi helu and Miliola limestone" as Lower part, "the Mizzi helu poor in fossils" as Upper part. Both parts are separated by the "*Acteonella flint beds*".

The Mizzi helu correlates the "*Obere Hippuritengruppe* of Fraas" (1867, p. 56) and corresponds with Shalem's (1927, p. 183) upper stage of his *calcare superiori a radioliti.*

Mizzi jehudi (*Yahudi*) name introduced by Blanckenhorn (1905, p. 80) and included by him in the "*Untere Mizzi*" or zone of *Acanthoceras palestinense.* But Shalem (1925, p. 169, 1927, p. 181) showed that the Mizzi yahudi in the neighbourhood of Jerusalem is a constant strata which overlies "der jasini" and the "Acanthoceras-zone". In Picard's last discussion (1938, p. 6), they are mentioned as "particularly thick beds (100m) of grey dolomite and dolomitic limestone which present themselves in the landscape in the shape of wild, jagged rock formations". The record of *Pecten alpinus* d'Orbigny, *Cerithium elias*, gives the fauna still a distinct Cenomanian character.

Mottled zone. Name given by Picard (1931, p. 52) for a 250 m thick series of variegated, very pyritic, somewhat phosphatic, silicified limestone, which frequently contains gypsum and clay. Bitumen and pyrites cause different processes of reduction of metallic compound, which leads to the multicolour of the rocks. The sediments were deposited originally in a lagoonlike basin.

The mottled zone has formerly been recorded only from the Judean desert (Jerusalem-Dead Sea, Hebron-Dead Sea) but has

recently been found in the Shephela-coastal region at Innaba (Avnimelech 1936, p. 53). Hull (1886, p. 98) thought them to be of volcanic origin. It probably corresponds with Anderson's (1852, p. 162) zone of the "*friable chalk of the Upper strata*". Lartet (1862, p. 171–173) calls them more correctly "*couches bigarrées de rouge avec de gypse*". Blanckenhorn (1915, p. 190) regarded the rocks as Danian; Picard followed this conception with reservation as no fossils were known. But recently Picard (1932 unpublished) found *Pecten obrutus* in the base-strata at Khan el Ahmar on the Jerusalem-Jericho road. According to this fossil, which occurs in both stages, Maestrichtian and Danian the lower part of the mottled zone still belongs to the Cretaceous.

Mozamarl (Picard) vide *Argille a Corbula eretzisraelensis* (Shalem).

N.

Nasb Limestone vide *Wadi Nasb Limestone*

Nubian Sandstone. Name introduced by Russegger (1845) for a series of variegated sandstone which has been regarded by him as equivalent to the Trias (Keuper). Botta (1833 "terrain sabloneux") dated the N.S. as between Jurassic and Cretaceous. Lartet, (1869, p. 122) considered the "terrain sabloneux" as Cretaceous. This sandstone becomes very abundant and in great thickness near Petra and in the Hejaz. The old Nabatean town of Petra is built as rock-town in the Nubian sandstone. Lartet therefore calls the N.S. also *grès de Petra* and gave the following description (1869, p. 123): Ces grès sont micacés, plus ou moins argileux, d'une dureté très variable, ils alternent avec de nombreux lits d'argile colorés diversement comme eux, en jaune, rouge, noir et vert, par des oxydes de fer, de manganèse et parfois même par du carbonate de cuivre. On y rencontre frequemment des lits imprégnés de sel, des couches plus ou moins minces de lignites ainsi que quelques veines métallifères". Hull (1886, p. 50) wanted to reserve the name N.S. only for the upper portion of the sandstone which he regarded as Cenomanian. For the lower series of sandstone he, however assumed a carboniferous age and named it "desert sandstone" (p. 44). Blanckenhorn (1914, p. 7) regards the N.S. to be of different age representing the Paleozoicum and the Mesozoicum from Cambrium to the Cretaceous. This view has been further confirmed by the description of Trias-

sic (Cox 1924, p. 52) and Jurassic (Cox 1925, p. 169 and Muir-Wood 1925, p. 181) fossils from the eastern part of the Jordan rift out of calcareous, dolomitic and marl beds which are intercalated between different parts of Nubian sandstone. These phenomena prove sufficiently that N.S. should be used as a facies name. The facies indicates the permanent struggle between the transgressive sea in the west and the aeolic or terrestrical ingressive forces of the East, the latter originating from the interior of the Arabian shield. According to Picard the Nubian facies has governed the Arabian shield from the end of the Precambium till the present time (e.g. Usdum series, recent red-Desert dunes). Kober (1919, p. 23, 24) would like to restrict the definition N.S. for his "Wüsten-facies" or arid facies being a sandstone, free of any transgressive marine sediments, in contrast to his "Peträische facies" where both continental and marine formations are represented.

Nerineenmarmor Fraas (1867, p. 53) correlates the Mizzi helu (Turonian).

Naharaimschotter. Naharaimschotterstufe named by Picard (1932, p. 186, 223) for a distinct horizon of Pleistocene gravel and sand-beds being distributed in the Jordan valley basin. Underlaid by the terra-rossa like loam (the "Basis lehme A") and overlaid by a loamy strata (the"Hangendlehme B") the Naharaimschotter represents the Older Pleistocene, or Pluvial A in Picard's chronology. They correlate with Nötlings (1887, p. 87) "altalluviale Jarmukschotter". The name is derived from the electric power station Naharaim (Hebrew: double river) near the inflow of the river Jarmuk into the river Jordan from where this horizon has first been described.

Nari (arabic: nar—fire). Name introduced by Blanckenhorn (1905, p. 117) for the "Deckelgestein" of Fraas (1867, p. 202). Nari is a calcareous surface crust consisting mainly of pure $CaCO_3$, which covers the soft and mostly calcareous rocks. Its origin has been thought to be caused by rainwater, which penetrates into the calcareous rocks and dissolves the lime of the rock. Then by the influence of sunrays, a retrogressive process starts and raises this limy-water by capillary force into fine channels and veins up to the surface of the rock, forming there a cover or crust. The nari crust therefore depends greatly on Mediterranean climatic conditions. It is only observed in Palestine, in such regions where sufficient rainfall

governs. For Palestine, Picard (1932, p. 213) noted a rain figure of 300 mm per annum as minimum for the development of Nari. Nari is therefore missing in the more arid parts of the country and has no stratigraphic meaning.

O.

Oberterrasse provisionally named by Picard (1932, p. 230) for gravel terraces found on the flanks of the tributaries of the Jordan at certain heights (20m) above the Lower Terrace of the river. They suggest a correlation with the "Blockschotterdelta". These heaps of blocks and boulders are found in most of the entrances to the tributaries into the Jordan plain. They are of delta-shaped form and they lie upon the "Jordan Hauptterrasse". According to Picard they belong to the transitional zone between Pleistocene and Holocene and represent possibly a last or short Pluvial—his "*Pluvial* C".

Obere Hippuritengruppe vide "*Mizzi helu*".

Old lake Terrace of Jordan-Arabah valley (Hull) correlates with *Hauptterrasse*.

Obere Missi (Blanckenhorn) correlates with the *Mizzi helu*.

Obere weisse Kreide etc. (Russegger 1847) vide *Untere Juragruppe*.

Oolithic formation a facies name used by Picard (1931, p. 61) for a layer of oolithic limestone from the neighbourhood of Nebi Musa in the Judean Desert. This oolithic series, which has also been recorded by Blake (1928, p. 6), is dated as of Upper Pliocene-Lower Pleistocene age. Most recent research strengthened the opinion that the strata is of an early Pleistocene age.

Other oolithic limestone of lacustric origin but of Lower-Middle Pliocene age (*Hydrobia Fraasi*) has been recorded from the Northern Jordan valley (Blanckenhorn 1914, p. 36). Marine Pliocene oolithic limestone has been known from the Plain of Esdraelon and Plain of Haifa (Picard 1928, 1929; Blake 1930), Marine oolithic limestone of Quaternary age from the Philistean Plain has been stated (Blanckenhorn 1914, p. 37).

Oolithic sandy limestone of Lower Cretaceous age from the Wadi Fara in Samaria and from Northern Galilea has been found by Blake (1928, p. 11.) and Picard (1934, p. 27.).

P.

Pectunculus sediments, Pectunculus layers, beds, named by Petrbok (1925, 1926) for shell and sand lenses irregularly placed in the sand of the cliff of the coast (Jaffa etc.). They consist mainly of shells of *Pectunculus*. Because of Roman pottery found there, Petrbok regarded these beds as originating in historic times. But Range (1932, p. 57) pointed out that the pottery has not been found in situ. Therefore the age of Pectunculus beds may still be Pleistocene, as Blanckenhorn previously considered them (1914, p. 37). For further reference see Picard (1935; 1938, p. 244).

Peträische Facies (Kober) vide *Nubian sandstone.*

Pileolus oliphanti vide *Stufe* des *P. o.*

Phosphatkalke, Phosphatic limestone, vide *Phosphorittrümmerkalke.*

Phosphorittrümmerkalke. Name applied by Koert (1924, p. 39, 40) for phosphatic beds first discovered by Blanckenhorn (1898) and in several notes later described by the same author. The brecciated nature of the rock has been specially investigated by Krusch (1911, p. 397) who gave it the name *Trümmergestein.* Blanckenhorn placed the "Phosphatkalke" or "Koprolithenkalke" mostly in the Campanian, sometimes in the Danian. Koert regarded them as Danian. The fossils *Libycoceras, Bostrychoceras, Ptychoceras,* however, suggests a Maestrichtian age of this "Phosphatic limestone" as Picard (1929a, p. 433) pointed out. The phosphate beds are distributed over the whole Transjordan, Southern and Middle Palestine and again observed in the more eastern part of Syria.

A green, cristalline, apatitic variety of phosphatic limestone, quarried in the neighbourhood of Bethlehem, is locally named *Mizzi ahdar* (the green Mizzi).

R.

Rukkadlava. Name applied by Noetling (1887, p. 87) for a lava stream once flowing from the Rukkad-Wadi into the Yarmuk valley until its entrance into the Jordan valley (East and southeast of the sea of Galilea). Noetling considered the lava to be of an Old Alluvial age. But, as Picard (1932, p. 206) recently showed, the lava is interbedded between "Lisanmarl" and "Naharaimschotter" and therefore has a Lower-Middle Pleistocene age. Blanckenhorn

assumed in 1914 (p. 44) a Middle Pleistocene age but afterwards (1932, p. 40–41) retained Noetlings conception of an Alluvial age of Rukkad-and also Zeijtun lava.

Rudist-Meleke series (Blake 1936) vide *Meleke.*

Ramleh facies. Name given by Picard and Solomonica (1936, p. 194) for strata superincumbent on the Zeita-Qubeibehfacies and considered to be the upper part of the Oligocene series of the coastal region. The rocks, first discovered by Blake (1928) in a quarry near Ramleh, consist of embedded, compact and slightly sandy limestone. After much controversy finally placed in the Middle-Upper Oligocene (for discussion vide also Cox 1936, Avnimelech 1936).

S.

Stufe des Pileolus Oliphanti (Noetling). Name given by Noetling (1886, p. 843) to a very fossiliferous horizon in the Carmel which seems to correspond to the *Calcare inferiori a Radioliti* of Shalem (1927, p. 174). Fauna described by Boehm (1900, p. 219) from the village Ijzim on the Carmel.

Stufe des Radiolites syriacus (*-Eoradiolites liratus* Conrad) of Noetling (1886, p. 842) correlates the Meleke of the Lower Turonian of Jerusalem.

Sakieh beds named by Löwengart (1927, p. 13, 14) for blue marine clay beds found in a bore hole at Sakieh, a village near Jaffa, and underlying the Pleistocene of the coastal plain. Considered at the time (1921, p. 196) by Range to be Senonian; Löwengart originally (1927, p. 13) considered a Miocene or Pliocene age; Picard (1927, p. 9) suggested Pliocene. A year later Picard (1928, p. 337) regarded them as Plaisancian (-Pontian), Löwengart (1928, p. 504) as 3d Mediterranean stage. The fauna at that time was determined by Oppenheim (Löwengart 1928, p. 500) and Cox (Blake-1928) and is now generally regarded as representing the Plaisancian stage.

Data regarding the Plaisancian marls have been recently furnished by Avnimelech (1936), Blake (1936), Picard and Solomonica (1936), Picard and Avnimelech (1937).

Samachschotter. Name applied by Picard (1932, Taf. 24) for base-gravel partly representing the Lisan-marl near Samach at the Sea of Tiberias and like the latter considered to be of Pleistocene

age. A fresh water fauna out of these strata has first been described by Noetling (1886). Recent investigations have also been carried out by Petrbok (1925). The name Samachschotter indicates only a facies within the Lisan series.

Couches de Sara or *Sara beds* term introduced by Avnimelech (1936, p. 67) for a series of soft, chalky rocks (rich in sponges) and of overlying flint bearing limestone, exposed at Sara near Artuf on the western border zone of the Judean Mountains. In comparison with rocks of similar facies and the same stratigraphical position in other parts of the country, containing nummulites of Lower Lutetian character, the greater part of the Sarabeds is regarded by Avnimelech as Lower Eocene. They correspond partly with the "Übergangsschichten" of Picard (1928) from Northern Palestine.

T.

Tertiary shell-tufa of Akka name given and only used by Anderson (Lynch 1842, p. 125) very probably for the reddish calcareous sandstone dated by Picard (1928a, p. 329) as Middle-Upper Pliocene which is distributed partly over the plain of Haifa and Akko (Acre).

U.

(Jebel) *Usdum series.* Name given by Lees (1931, p. 266) and by Wyllie (1931, p. 368) for a series of fine stratified layers of about 100 ft. thickness composing partly the Jebel Usdum. The Jebel Usdum is an isolated salt-dome mountain on the S.W. border of the Dead sea, flanked by the so-called Usdum series. The lower part (500 ft. thickness) of the Usdum series consists of red and grey sands with thin shale beds and some gypsum intercalated by thin layers containing abundant fish and plant remains. The upper part (500–600ft.) consists also of shales but is richer in gypsum interbedded with some thin limestone bands and some dark shale containing plant remains.

The intrusive rock salt (of uncertain age) has disturbed in many ways the U. series. According to Wyllie (1931) and Lees (1931, p. 266) the U. series are of any age from Eocene upwards. Generally speaking the U. series has to be regarded as of Tertiary age. Picard (1929, p. 46) and Lees (1931, p. 266) assumed a correlation of the J.U. Series with the Pliocene beds of Melhamije in the Upper

Jordan valley. Pliocene age has also been assumed by Blake (1928, p. 23). According to Lees (p. 266) the Usdum Series outcrops on the Eastern flank of the Dead Sea (near el-Lisan) rest unconformably on the Upper Cretaceous. For paleogeographic (hitherto unpublished) reasons Picard is now inclined to regard the J. Usdum Series as of Oligocene-Miocene age.

Untere Juragruppe named by Russegger (1847, p. 247) [who published the first geological map of the country] for strata, however, belonging to the Cenomanian-Turonian. The Senonian Russegger described more correctly as "Obere Weiße Kreide voll Feuerstein und Feuersteinstrata". Anderson's (1852, p. 162) *lower strata of the cliff* corresponds to the Untere Juragruppe.

Upper Terrace near Beisan (Anderson 1852) vide *Hauptterrasse.*

Upper Gravel horizon vide *Gravel horizon.*

Untere Hippuritengruppe Fraas vide "Meleke".

Untere Mizzi or Zone des *Acanthoceras palestinense* and *A. rhotomagense* vide discussion on *Mizzi yahudi.*

Volcani rocks vide "*Basalt lava* of *Tiberias*" and Grundgebirge.

W.

Wadi Nasb Limestone name given by Hull (1886, p. 45) for Carboniferous limestone of the Sinai which he applied for a similar facies found by him in the Wadi el Hesi (Southwest of Kerak), et Tlah, below Kerak, etc. in Transjordan. In the Sinai this horizon is intercalated between the lower part of the Nubian sandstone (Hull's desert sandstone) and conglomerates and the higher series of Nubian sandstone containing numerous Carboniferous fossils. But in the Wadi el Hesi region Blanckenhorn (1912, p. 129) and latter the Turkish Petroleum Co. Expedition (King 1923, p. 507) discovered only Cambrian fossils.

Wüstenfazies (Kober) vide *Nubian Sandstone.*

Z.

Zone des Ammonites (Knemiceras) syriacus (Buch). Name given by Fraas (1878, p. 76) for the strata underlying the Cenomanian in Syria. Blanckenhorn (1931) considered the "*Buchicerasstufe*" as of Vraconnian age. *Knemiceras syriacum*, however, is regarded by other authors as type fossil of the Albian. Since Blake (1928, p. 11)

discovered this ammonite in the Wadi Fara, west of Nablus (Samaria) and very recently (1936) near Ramallah there is every reason to establish the zone of *Knemiceras* in Palestine.

Zeijtun-lava name give by Noetling (1887, p. 87) for a lava stream (Southeast of the Sea of Galilea) considered by him as of Old Alluvial age. As Picard pointed out for the Rukkadlava the Zeijtunlava may be of similar age i.e. between Middle and Older Pleistocene (vide remarks on *Rukkadlava*).

Zeita-Qubeibehfacies named by Picard and Solomonica (1936, p. 194) for partly marly, partly quartzitic sandy, but mainly chalky rocks (yielding foraminifera, amongst them *nummulites*) from the neighbourhood of Zeita and Qubeibeh near Jibrin (Hebron District). These occurences are mentioned in several papers by Blake (1929, 1936), Blanckenhorn (1931), Cox (1934), Avnimelech (1936) etc. and regarded now by most of the authors as of Stampian-Aquitanian age. According to Picard and Solomonica the Zeita-Qubeibehfacies is underlain by the Jibrin Series (without uncomformity) and overlain by the Ramlehfacies.

LITERATURE

ANDERSON, H. J. vide Lynch

AVNIMELECH, M. *Etudes géologiques dans la région de la Shéphélah en Palestine*. Grenoble 1936.

BLAKE, G. S. *Geology and Water Resources of Palestine*. Jerusalem 1928.

BLAKE, G. S. *The Stratigraphy of Palestine and its Building Stones*. Jerusalem 1936.

BLANCK, E. "*Die Mediterran-Roterde*". Handbuch der Bodenlehre. III. 1930.

BLANCKENHORN, M. *Zur Kenntnis der Süsswasserablagerungen und -Mollusken Syriens*. Palaeontographica XLIV. Stuttgart 1897.

BLANCKENHORN, M. *Geologie der näheren Umgebung von Jerusalem*. Zeitschr. d. Deutsch. Paläst. Vereins. XXVIII. p. 75 ff. Leipzig 1905.

BLANCKENHORN, M. *Die Hedschazbahn auf Grund eigener Reisestudien.* Part I. Zeitschr. d. Gesellschaft f. Erdkunde zu Berlin. 1907. No. .4

BLANCKENHORN, M. *Naturwissenschaftliche Studien am Toten Meer und im Jordantal.* Berlin 1912.

BLANCKENHORN, M. *Syrien, Arabien und Mesopotamien.* Handb. d. regional. Geologie V, 4. Heidelberg 1914.

BLANCKENHORN, M. *Das Danien in Palästina mit der Leitform Pecten obrutus.* Zeitschr. deutsch. geol. Ges. Monatsber. LXXVII, 1915.

BLANCKENHORN, M. AND OPPENHEIM, P. *Neue Beiträge zur Kenntnis des Neogens in Syrien und Palästina.* Geolog. und Palaeontol. Abhandlg. XV. Neue Folge, Heft 4. Jena 1927.

BLANCKENHORN, M. *Geologie Palästinas nach heutiger Auffassung.* Zeitschr. d. Deutsch. Palästina Vereins. LIV. 1931.

BOTTA, P. E. *Observations sur le Liban et l'Antiliban.* Mém. Soc. Geol. de France. I. sér. t.I. p. 135. Paris 1833.

BURCKHARDT, F. *Travels in Syria* and *Palestine.* London 1822.

COX, L. R. *A Triassic fauna from the Jordan Valley.* Annals and Magaz. of Nat. Hist. ser. 9. XIV. p. 52. 1924.

COX, L. R. *A Bajocian-Bathonian Outcrop in the Jordan Valley, and its Molluscan Remains.* Annals a. Magaz. of Nat. Hist. ser. i. XV. p. 169. 1925.

DUBERTRET, L. *Etudes des régions volcaniques du Haouran, du Djebel Druze et Diret et Touloul (Syrie).* Revue de Géographie physique et de Géologie dynamique. II. Paris 1929.

FRAAS, O. *Aus dem Orient.* I. Teil: Geologische Beobachtungen am Nil, auf der Sinai Halbinsel und in Syrien. Stuttgart 1867.

FRAAS, O. *Aus dem Orient* II. Teil: Geologische Beobachtungen am Libanon. Stuttgart 1878.

FUCHS, E. *Beiträge zur Petrographie Palästinas und der Hedschazprovinz* –Neues Jahrb. f. Min. Geol. Palaeont. Beilg. Bd. XL. Stuttgart 1915.

HULL, E. *Memoir on the Geology and Geography of Arabia, Petraea, Palestine and adjoining districts.* Survey of Western Palestine. Palestine Exploration Fund. London 1886.

KING, W. B. R. *Cambrian fossils from the Dead Sea.* Geolog. Magaz. LX. London 1923. pp. 507 ff.

KOBER, L. *Geologische Forschungen in Vorderasien. II Das nördliche*

Hegaz. — Denkschr. math. naturw. Kl. Akad. Wiss. XCVI. pp. 729 ff. Wien 1919.

KOERT, W. *Geolog. Beobachtg. in Syrien u. Palästina etc.* Zeitschr. Deutsch. Geol. Ges. LXXVI. 1924.

KRUSCH, P. *Die Phosphatlagerstätten bei Es-Salt im Ostjordanland.* Zeitschr. für praktische Geologie. XIX. pp. 397–496. Leipzig 1911.

LARTET, L. *Essai sur la Géologie de la Palestine et des contrées avoisinantes etc.* — Annals des sciences géologiques, 1 èreannée, Part I. Paris 1869.

LEES, G. M. *Salt — some depositional and deformational problems. "Symposium on Salt Domes".* — Journ. of the Institution of Petroleum Technologists. No. 91. LXXI. pp. 259–280. 1931.

LIBBEY, W. AND HOSKINS, F. E. *The Jordan Valley and Petra.* Vol. II. — New-York — London. 1905.

LOEWENGART, St. *Zur Geologie der Küstenebene Palästinas.* Centralbl. f. Miner. etc. Abt. B. 1928.

LOEWENGART, *The groundwater of the Palestinian coastal plain*, Journ. Assoc. Architects-Engineers. Tel-Aviv 1927.

LYNCH, W. F. *Official Report of the United States Expedition to explore the Dead Sea and the river Jordan.* With *: Geological Reconnaissance of Part of the Holyland"* by H. J. ANDERSON, Baltimore 1852.

MUIR-WOOD, H. M. *Jurassic Brachiopoda from the Jordan Valley.* Annals and Magaz. Natural Hist. ser. 9. XV. pp. 181-192. 1925.

NOETLING, F. *Geologisch-Palaeontologische Mitteilungen aus Palästina.* I, II. Zeitschr. Deutsch. Geol. Gesellsch. XXXVIII. 1886.

NOETLING, F. *Geologische Skizze der Umgebung von el-Hammi.* Zeitschr. deutsch. Palästina Vereins. X. 1887.

PETRBOK, J. *La Stratigraphie et Paléontologie de la terrasse pluviale de Jourdain près de Daganea Alef.* Bull. intern. Acd. des Sciences Bohême. Prag 1925.

PETRBOK, J. *The age of the Pectunculus sediments near Jaffa in Palestine.* Bull. inter. Acad. des Sciences Bohême. Prag 1925a.

PETRBOK, J. *Evidences as to the real age of the Pectunculus beds near Tel-aviv etc.* — Bull. inter. Acad. des Sciences Bohême. Prag 1926.

PICARD, L. *Springs and groundwater in Esdraêlon valley and the coastal plain.* — Bull. of the Associat. of Architects etc. No. 5–6. 1927.

PICARD, L. *Zur Geologie der Kischonebene.* Zeitschr. Deutsch. Paläst. Ver. LI. 1928.

PICARD, L. *Über die Verbreitung des Pliocäns im nördlichen Palästina.* Centralblatt für Min. Geol. Paläont. Abt. B. No. 5. Stuttgart, 1928 a.

PICARD, L. *Zur Geologie der Besanebene.* — Zeitschr. Deutsch. Paläst. Vereins. LII. 1929.

PICARD, L. *On Upper Cretaceous Ammonoidea from Palestine.* Annals and Magazine of Natural History. ser. 10. III. p. 433. 1929.

PICARD, L. *Tektonische Entwicklungsphasen in nördlichen Palästina.* Zeitschr. Deutsch. Geol. Gesellsch. LXXXIII. p. 164. 1931 (a).

PICARD, L. *Geological Researches in the Judean Desert.* — Jerusalem 1931 (b).

PICARD, L. *Zur Geologie des mittleren Jordantales.* Zeitschr. d. deutschen Palästina Vereins LV. 1932.

PICARD, L. *Mollusken der levantinischen Stufe Nordpalästinas.* Archiv für Molluskenkunde. 1933.

PICARD, L. *Geology of Tel-Aviv* (Hebrew). — Tel-Aviv 1935.

PICARD, L. AND SOLOMONICA, P. *On the Geology of the Gaza-Beersheba District.* Journ. Palest. Orient. Soc. XVI. 1936.

PICARD, L. AND AVNIMELECH, M. *On the Geology of the Central Coastal Plain.* Journ. Palest. Orient. Soc. XVII. 1937 a.

PICARD, M. *Inferences on the Problem of the Pleistocene Climate of Palestine and Syria etc.* Proceed. Prehistoric Soc. London 1937.

PICARD, L. *The Geology of New Jerusalem.* Bull. Geol. Dept. Hebr. Univ. vol. II. No. 1. 1938.

RANGE, P. *Die Geologie der Küstenebene Palästinas.* Zeitschr. d. Deutsch. Geol. Gesellsch. LXXIII. Monatsber. 1921. p. 194.

RANGE, P. *Wissenschaftliche Ergebnisse einer geologischen Forschungsreise nach Palästina im Frühjahr 1928.* Zeitschr. d. Deutsch. Paläst. Vereins. LV. 1932.

REIFENBERG, A. *Die Entstehung der Mediterran-Roterde* (Terra rossa). Koloiddchemische Beihefte. Leipzig 1929.

RUSSEGGER, J. *Reisen in Europa, Asien und Afrika.* Stuttgart 1845–49. vol. III. 1847.

SEETZEN, U. J. *Brief Account of the Countries adjoining the Lake Tiberias, the Jordan and the Dead Sea.* London 1810.

SHALEM, N. *IL Cenomaniano ad occidente di Gerusalemme.* Bolletino Società Geolog. Italiana. XLIV. p. 155. 1925.

SHALEM, N. *La Creta superiore nei dintorni di Gerusalemme.* Boll. Soc. Geol. Ital. XLVI. p. 171. 1927.

SHALEM, N. *Fauna nuova cenomaniana delle argille verdi di Gerusalemme.* Boll. Soc. Geol. Italiana. XLVII. p. 69. 1928.

TAUBENHAUS, H. *Die Amoneen der Kreideformation Palästinas und Syriens.* Zeitschr. d. deutschen Palästina Vereins. XLIII. 1920.

VAN INGEN, G. *Appendix VII.* p. 353 in LIBBEY and HOSKINS vol. II.

VROMAN, J. *Geology of the region of the Southwestern Carmel (Palestine).* Proefschrift. Univ. Utrecht 1938.

WALDMAN, L. *Petrographische Beschreibung der von L.* KOBER *im nördlichen Hedschas und im Taurus gesammelten Gesteine.* — Sitzungsber. d. Akad. d. Wiss. Math. — naturw. Klasse. Abt. I. CXXXV. p. 317. Wien 1926.

WYLLIE, B. K. N. *The Geology of Jebel Usdum, Dead Sea.* Geolog. Magaz. LXVIII. p. 366. 1931

השואת המונחים הסטרטיגרפיים לגאולוגיה של ארץ ישראל

ל. פיקרד

השואה זו הוכנה תחילה לפני כמה שנים בשביל „Lexicon international de Stratigraphie" כרך „Asia". דומה שכרך זה לא יצא לאור בקרוב וכיון שגם גיאולוגים וגם לאי־גיאולוגים דרשו השואה כזו כדי להקל להם את קריאת הסיפרות הגיאולוגית הארץ־ישראלית החלטתי לא לעכב את פרסומה. לכן לא נכלל בהשואה זו שוב מונח סטרטיגרפי בין־לאומי מלבד שתי הגדרות בלתי ברורות. „דרגת אמשר" („Emscherstufe") „והרי מסד" (Grundgebirge). ותרנו על סכום מפורט בעברית כיון שלקורא העברי תנתן הסברת „חמונחים הסטרטיגרפיים" האלה שהופיעו בלשון אירופית — בעבודה עברית רחבה יותר על הגיאולוגיה של ארץ־ישראל.