وزارة الداخليـــة
مصلحة المساحة الجيولوجية الامريكية
DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

المملكة العربية السعودية
وزارة البترول والثروة المعدنية
KINGDOM OF SAUDI ARABIA
MINISTRY OF PETROLEUM AND MINERAL RESOURCES

أبحاث جيولوجية مختلفة
خريطة رقم A ٢١٨-I
MISCELLANEOUS GEOLOGIC INVESTIGATIONS
MAP I-218 A

GEOLOGIC EXPLANATION

التفسير الجيولوجي

QUATERNARY

Qes — Eolian sand
Mostly mobile. (See legend for description of sand terrain type)

Ql — Lake terraces
Low terraces composed of interbedded white, tan and brown, fine quartz sandstone with micaceous, silty, occasionally gypsiferous clay and fossiliferous silt; distribution incompletely known; late Pleistocene(?) to early Recent in age

Qs, Qgy, Qg, Qu — Silt, gypsum, and gravel
Silt and associated fine sediments including caliche-like and gypsiferous deposits in undrained depressions, Qs; white to tan, powdery to platy gypsum, Qgy, along east margin of Nafūd Aḍ Ḍāḥī: lag and other gravel of local origin composed of limestone, sandstone, and quartz pebbles in part the lag from originally extensive gravel sheets and trains, Qg; locally includes some patches of duricrust, Qdc, gypsum, silt, Qs, and coarse grained equivalents of Tsm; unconsolidated surficial deposits of silt, sand, gravel, and gypsum, possibly including unrecognized equivalents of other units of Quaternary age, Qu

Qg₂ — Gravel
Sheets and trains of gravel composed of varying proportions of limestone and basement complex pebbles, probably for the most part near its original relative elevation; in places includes some sandstone and quartz pebbles, and boulders along front of Banī Khaṭmah scarp, and common small, scattered patches of duricrust, gypsum, marly silt, and coarse grained equivalents of Tsm

Qdc — Calcareous duricrust
Gray to tan, sandy limestone, locally gypsiferous, grades locally into thin calcareous cemented sandstone. Distribution incompletely known

TERTIARY AND QUATERNARY — Pliocene(?) and Recent

QTgs — Gravel and sand
Fluviatile terraces, very localized lacustrine deposits, loess flats, alluvium, gravel and sand; distribution of individual units incompletely known

TERTIARY — Miocene and Pliocene

Tsm — Limestone and sandstone
Light to dark gray, white, buff, and tan, hard to soft, occasionally saccharoidal and chalky, commonly argillaceous, fossiliferous fresh water limestone with sandy limestone, and friable, calcareous-cemented sandstone; locally with abundant gastropods and small clams. In places, probable equivalent units mapped as gravel

Paleocene and Eocene — Lower Eocene

Tj — Jeza' formation
Yellowish-green, calcareous shale with thin beds of marine foraminiferal limestone; in places, becomes chalky with slightly massive bedding; includes some marl. Partly equivalent to the upper part of the Umm er Radhuma formation of Saudi Arabia

Paleocene and Lower Eocene

Tu — Umm er Radhuma formation
Thick bedded, massive, hard, compact, semi-crystalline limestone: in Wādī Ḥaḍramawt and to the south divisible into an upper buff and white weathering, nodular limestone, and a lower massive, dark brown weathering, locally dolomitic limestone unit

CRETACEOUS — Lower and Upper Cretaceous

Kwb — Wasi'a and Biyadh formation, undivided
Black, reddish-brown, gray and white, commonly crossbedded, quartz sandstone with hard quartzite beds; at places ironstone beds and quartz pebble conglomerate at several levels; few thin shale zones develop southward

Kt — Tawilah group
In the East Aden Protectorate in caliche facies of sandstone with siltstone and subordinate shale and marl; of lagoonal and deltaic origin; plant remains present. May be partly equivalent to the Aruma and Wasi'a and Biyadh formations, Kwb, of Saudi Arabia, and equivalent to the Mahra group, Km, of the Southeastern Rub al Khali quadrangle, map I-220A; also equivalent to the Taouillah series of Yemen (Lamare, et al). In coastal southwestern Ḥaḍramawt, the uppermost part of the Cretaceous consists of sandstone and siltstone with marl and shale. The middle part of the Cretaceous is of a similar facies including limestone tongues with shale and marl horizons. The lowermost part of the Cretaceous consists of clastics with a limestone horizon near the base. Age range of the Tawilah group is Barremian to Maestrichtian

JURASSIC — Upper Jurassic

Jj — Jubaila formation
White to cream, occasionally pinkish-orange, chippy weathering, lithographic limestone overlying a light to dark gray and red hard dolomite that weathers gray, tan, and brownish-red; dolomitization increases southward. At southern part of Banī Khaṭmah consists predominantly of gray, white and red, saccharoidal dolomite with subordinate dolomitic limestone and local siliceous zones; some sandy limestone in Al Munbaṭiḥ area partially masked by a thin veneer of duricrust

Jh — Hanifa formation
Cream and tan, fine grained, compact limestone with many horizons of brown and tan oolite and detrital calcarenite; coral and milliopores at many levels; southward gray and red weathering dolomite predominates in upper part; in southern part of Banī Khaṭmah area includes thin zones of black-weathering chert and silicified coral

Jtm — Tuwayq Mountain limestone
Cream and tan fine grained to lithographic limestone weathering gray, white and tan; coral heads in position of growth at many levels; southward includes a basal unit of interbedded, brown sandstone and sandy limestone locally becoming strongly dolomitized

Middle Jurassic

Jd — Dhruma formation
Buff, white, red, and brown, usually crossbedded sandstone with a few quartz pebble lenses near middle part; locally, subordinate tan and gray shale and thin ironstone horizons near top; southward formation thins rapidly and wedges out near Khashm Ghudayy

PERMIAN OR TRIASSIC

TrPs — Sudair shale
Predominantly brick red massive shale with some green and white zones and subordinate interbedded siltstone, sandstone, and silty limestone; wedges out south of Khashm Sudayr

PERMIAN

Pk — Khuff formation
White, pink, and red usually massive, locally crossbedded, commonly calcareous sandstone, weathering buff; includes interbedded red, green and gray shale and claystone; southward includes a thin sandy limestone and chert bed in basal part; includes some fossil wood; formation thins southward and near Banī Khaṭmah, identification is doubtful, Pk?

Pw — Wajid sandstone
Yellowish-brown, white, red, buff, and gray weathering to light and dark gray, brown, and tan, generally poorly sorted quartz sandstone; locally conglomeratic, partly crossbedded with common quartz granule and pebble zones, and thin silty to shaley units; in Khashm Khaṭmah area includes two zones of igneous and metamorphic boulders in middle and upper parts; presumed to be Permian or older in age

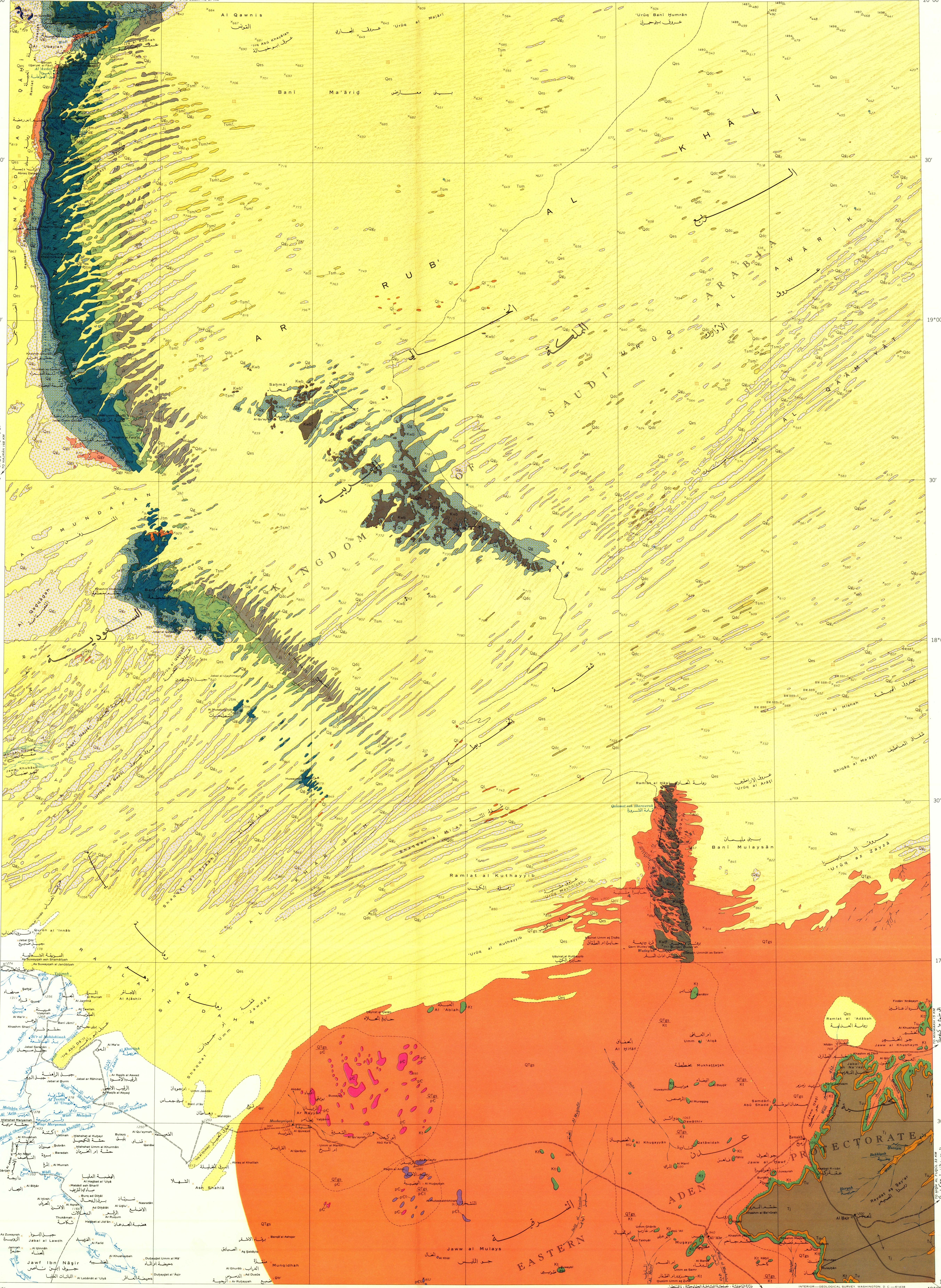
PRECAMBRIAN

p€t — Thaniya group
A thick series of contorted, highly cleaved metasedimentary rocks consisting of dark quartzite, graphitic calc-schist, and thin bedded phlogopite marble overlying thick-bedded calcareous rocks with chert bands; includes associated volcanics. Believed equivalent to the Wadi Medina series (after R. Karpoff and R. F. Geukens) of Saudi Arabia and Yemen

p€ — Extrusive rocks, granite, and gneiss, undivided

Geologic contact
Dashed where approximately located; short dashed where indefinite

Anticline



Prepared by the U. S. Geological Survey and the Arabian American Oil Company under the joint sponsorship of the Kingdom of Saudi Arabia and the U. S. Department of State.

Lambert conformal conic projection; standard parallels 17° and 33°

INTERIOR—GEOLOGICAL SURVEY, WASHINGTON, D. C.—61438

MAP LEGEND

اصطلاحات الخريطة

POPULATED PLACES — الاماكن الآهلة بالسكان
- Village or town — قرية أو بلدة
- Fort — حصن أو قلعة
- Ruins — آثار، أطلال

TRANSPORTATION — طرق المواصلات
- Major road, unpaved — طريق رئيسية غير معبدة
- Secondary road — طريق إعتيادية
- Road of questionable permanency — طريق غير ثابتة

HYDROGRAPHIC FEATURES — الاوصاف الهيدروغرافية
Only isolated wells are shown
- Dug well — بئر محفورة باليد
- Drilled water well — بئر ماء محفورة بآلة الحفر
- Intermittent stream — جدول متقطع
- Gypsum flat — سهلة من الجص

HYPSOGRAPHIC FEATURES — الاوصاف الهبسوغرافية
- Generalized relief — ارتفاع عمومي
- Prominent topographic features — اماكن طوبوغرافية مرتفعة
- Sand — الرمل

Dense stipple represents mobile sand cover consisting primarily of dunes, linear ridges, and other individual sand forms, that are shown where map scale permits; moderately dense stipple represents more stabilized continuous sand cover; open stipple represents discontinuous sand cover.

Types of sand terrain — انواع الاراضي الرملية

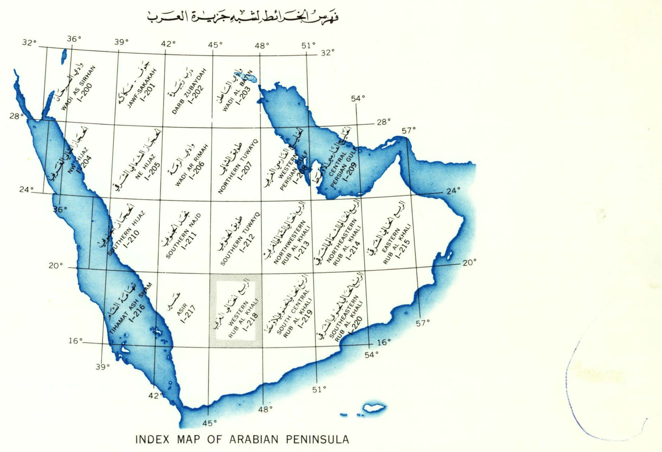
I — Transverse. *Predominantly simple and compound barchan dunes in areas of more mobile sand, and/or simple rounded ridges, both oriented transverse to the prevailing wind direction.*

II — Longitudinal. *Primarily dikākah and various types of undulating sand sheets, in general characterized by elongation of the individual topographic forms parallel to the prevailing wind direction, often partially stabilized by sparse vegetation.*

III — 'Urūq. *Various forms of long, nearly parallel, sharp crested narrow sand ridges and dune chains separated by broad sand valleys usually including elements of type I sand terrain. These are the resultant of a system of two dominant wind directions and are identical to the sayf dunes of North Africa.*

IV — "Sand mountains." *Dominated by large sand massifs commonly cresting 50 to 300 meters above the substratum, often with super-imposed dune patterns consisting of various types of complex barchans. Common forms are giant barchans spanning several kilometers from horn to horn; giant bisigmoidal and pyramidal sand peaks as well as other less common peak forms; and giant oval to elongate sand mounds.*

MISCELLANEOUS FEATURES — أوصاف مختلفة
- Bench mark (BM 887 × 585 meters) — علامة ثابتة لارتفاع موقع
- Triangulation station (1496 △ 462 meters) — نقطة المثلثات
- Spot elevation (× 620 meters) — علامة ارتفاع

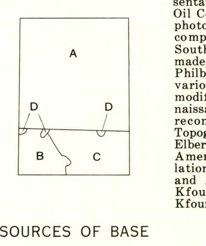


GLOSSARY

إيضاحات

ابرق ج برقان	Abraq; pl., Burqān	Rocky hill with sand on slopes
عقبة	'Aqabah (t)	Pass
عين	'Ayn	Spring, solution pit, or well
برقاء ج برق	Barqā'; pl., Burq	Same as abraq but broader
بئر	Bi'r	Dug well
حائرة ج حوائر	Ḥā'irah (t); pl., Ḥawā'ir	Terminal basin of a wādī or sha'b
حشة أو حشة ج حشاش	Ḥishshah (t), Ḥashshah; pl., Ḥishāsh	Hill
حزوم مفرده حزم	Ḥuzūm; (pl. of Ḥazm)	Elevated rocky terrain
عرق ج عروق	'Irq; pl., 'Urūq	Long linear sand ridge
جبل	Jabal	Hill or mountain
جو	Jaww	Pronounced sandy-bottomed depression or basin with gentle slopes
خشم	Khashm	Headland or promontory along a cliff or mountain front
نفود	Nafūd	Large area of sand dunes
قلمة	Qalamah (t)	Drilled well equipped with pipe
قرن ج قرون	Qarn; pl., Qurūn	Prominent mountain front
رملة	Ramlah (t)	Sand area
شعب	Sha'b, Sha'īb	Same as wādī, often a tributary
شقة ج شقاق	Shaqqah (t), Shuqqah; pl., Shiqāq	Valley or depression between 'urūq
وادي	Wādī	Valley or dry water course

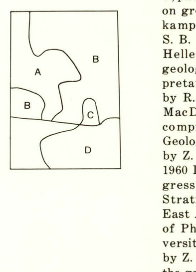
مصادر المجموعات الاساسية



Compilation and topographic representation by the Arabian American Oil Company: A, controlled aerial photographic surveys, 1958-59; B, compiled directly from "Routes in South-West Arabia" from surveys made in 1936 by Mr. H. St. J. B. Philby C. I. E.; C, recompiled from various published sources partly modified and amended from reconnaissance ground surveys; and D, reconnaissance ground surveys. Topographic representation by E. L. Elberg, Jr. and L. A. Castro, Arabian American Oil Company. Transliteration, transliteration, calligraphy, and Arabic typography by S. H. Kfoury, C. D. Matthews and M. H. Kfoury.

SOURCES OF BASE COMPILATION

مصادر المجموعات الجيولوجية



Geologic mapping by the Arabian American Oil Company compiled from: A, photogeologic interpretation based on ground surveys by R. D. Gierhart, L. D. Owens, R. A. Bramkamp, S. B. Henry, S. J. Roach, R. L. Maby, L. F. Ramirez and observations by other geologists; B, photogeologic interpretation based on ground surveys by R. A. Bramkamp, L. D. Owens, L. F. Ramirez, S. B. Henry, J. B. Sheehan, H. H. Helley, and observations by other geologists; C, photogeologic interpretation based on ground surveys by R. D. Frazer, S. J. Roach, R. D. MacDougall and others; and D, recompiled from "Synopsis of the Geology of East Aden Protectorate" by Z. R. Beydoun published by the 1960 International Geological Congress in Copenhagen, and "The Stratigraphy and Structure of the East Aden Protectorate", Doctorate of Philosophy Thesis, Oxford University. 1961, (pending publication) by Z. R. Beydoun. Translation of the geologic explanation edited by Harold W. Glidden, U.S. Department of State.

SOURCES OF GEOLOGIC COMPILATION

This map printed in two sheets: Sheet A, geology and geography combined; Sheet B, geography only. Available at the Directorate General of Petroleum and Mineral Affairs, Ministry of Finance and National Economy, Jiddah and Ad Dammām, Saudi Arabia, and the U. S. Geological Survey, Washington, D. C., U. S. A.

المقياس ١ : ٥٠٠٠٠٠

Scale 1:500 000

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GEOLOGY OF THE WESTERN RUB AL KHALI QUADRANGLE, KINGDOM OF SAUDI ARABIA

By
Richard A. Bramkamp, Ruel D. Gierhart, Lloyd D. Owens, and Leon F. Ramirez

خريطة جيولوجية للوحة الربع الخالي الغربي بالمملكة العربية السعودية

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أبحاث جيولوجية مختلفة
خريطة رقم A ٢١٨-I
MISCELLANEOUS GEOLOGIC INVESTIGATIONS
MAP I-218 A

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