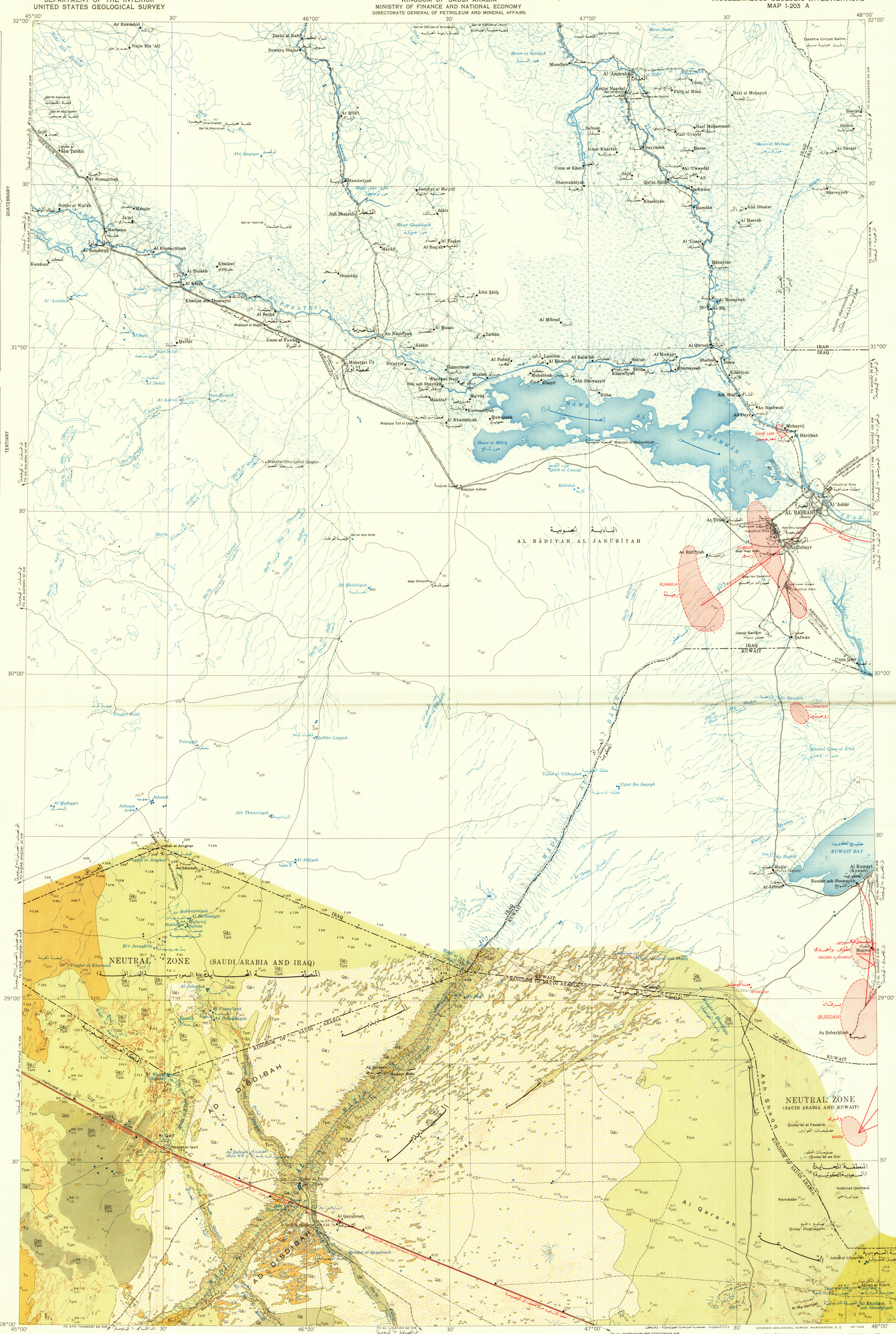
وزارة الداخلية
مصلحة المساحة الجيولوجية الأمريكية
DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

المملكة العربية السعودية
وزارة المالية والاقتصاد الوطني
المديرية العامة لشؤون النفط والمعادن
KINGDOM OF SAUDI ARABIA
MINISTRY OF FINANCE AND NATIONAL ECONOMY
DIRECTORATE GENERAL OF PETROLEUM AND MINERAL AFFAIRS

أبحاث جيولوجية مختلفة
خريطة رقم I-٢٠٣ A
MISCELLANEOUS GEOLOGIC INVESTIGATIONS
MAP I-203 A



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°

Indicated positions of boundary lines not demarcated on the ground are not necessarily definitive

INTERIOR—GEOLOGICAL SURVEY, WASHINGTON, D. C. MR 7638

GEOLOGY OF THE WADI AL BATIN QUADRANGLE, KINGDOM OF SAUDI ARABIA

By
Richard A. Bramkamp and Leon F. Ramirez

خريطة جيولوجية للوجة وادي الباطن بالمملكة العربية السعودية

وضع
ريتشارد بر مكامب وليون رامريز

GEOLOGIC EXPLANATION

Qes — **Eolian sand**
See map legend for description of sand terrain types

Qsb — **Sabkhah deposits**
Silt, clay, and muddy sand, commonly saline, underlying coastal and inland playas

Qs, Qg (Qu) — **Silt and gravel**
Silt and associated fine sediments including caliche-like and gypsiferous deposits in undrained depressions, Qs; lag and other gravels of local origin, commonly the lag from originally extensive gravel sheets and trains, Qg, shown as ⅝ in Widyan al Hamādiyāt area where it discontinuously overlies Tsm*; unconsolidated surficial deposits of silt, sand, and gravel may include unrecognized equivalents of other units of Quaternary age,* Qu

Qg₁, Qg₂ — **Gravel***
Limestone, quartz, or mixed limestone and quartz gravel in terrace deposits obviously related to present or recent drainage, Qg_1*; quartz gravel as sheets and trains with varying proportions of limestone and basement complex pebbles; probably for the most part near its original relative elevation,* Qg_2*, shown as ⅝ in western half of area where it discontinuously overlies* Tsm*; symbols queried where identification doubtful*

Qdc — **Calcareous duricrust**
Discontinuous mantle of red, brown, gray, tan, and yellow, usually hard, sandy limestone, often containing imbedded fragments of underlying rocks, varying in thickness from a few centimeters to 3 or 4 meters. Coarse frosted quartz sand grains are usually present, also a few fresh water mollusks. In many places the resistant duricrust carapace masks underlying rocks and where extensive hides underlying structure

Tsm, Th (Miocene and Pliocene) — **Sandstone, marl, and limestone**
Red, brown, and gray marly sandstone, sandy marl, and sandy limestone. Undifferentiated lateral equivalents of the Hofuf, Dam, and Hadrukh formations of the Northern Tuwayq and Western Persian Gulf quadrangles. In southeastern part of map Hadrukh formation of Miocene(?) age, Th*, at base; includes gray, tan, cream, and pink calcareous silty sandstone, sandy limestone, and sandy marl; locally cherty; at places contains nonmarine fossils*

Tu (Pliocene and Eocene) — **Umm er Radhuma formation**
Cream, tan, and gray limestone, dolomitic limestone, and dolomite

Geologic contact
Dashed where approximately located, short dashed where indefinite

* Qg_2 becomes progressively thinner and more discontinuous westward. Distribution of Tsm and Qg_2 incompletely known in northern part of Neutral Zone (Saudi Arabia and Iraq)

MAP LEGEND

POPULATED PLACES
- City or town
- Village
- Village name not given
- Fort

TRANSPORTATION
- Railroad with station
- Major road, paved
- Major road, unpaved
- Secondary road
- Road of questionable permanency
- Trail
- Airport
- Landing field

HYDROGRAPHIC FEATURES
Only isolated wells are shown
- Dug well
- Drilled water well
- Ditch or canal *Dashed where abandoned*
- Water pipeline
- Intermittent stream
- Sabkhah
- Khabrā
- Marsh or swamp
- Bathymetric contours, in meters

HYPSOGRAPHIC FEATURES
- Generalized relief

Sand
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

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 dibdibah 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 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 superimposed dune patterns consisting of various types of complex barchans. Common forms are giant barchans spanning several kilometers from horn to horn; giant bisymmetrical and pyramidal sand peaks as well as other less common peak forms; and giant oval to elongate sand mounds*

MISCELLANEOUS FEATURES
- Oil field
- Oil well
- Oil pipeline with pumping station
- Kilometer post (KP)
- Spot elevation — × 362 meters
- Benchmark — BM 105 × 403 meters
- Triangulation station — 270 △ 190 meters
- Border survey triangulation station — ⅝ JIN
- Ruins
- International boundary

INDEX MAP OF ARABIAN PENINSULA
Maps published by the U. S. Geological Survey shown by asterisk following name.

GLOSSARY

Abraq	أبرق	Rocky hill with sand on slopes
'Adāmah(t)	عدامة	Raised sand area
'Ayn	عين	Spring, solution pit, or well
Bandar (Persian)	بندر (الفارسية)	Harbor
Barqā'	برقاء	Same as abraq but broader
Baṭn	بطن	Depression or hollow, usually elongate
Bi'r	بئر	Dug well
Dasht (Persian)	دشت (الفارسية)	Plain
Dibdibah (refer to Ad Dibdibah on map)	دبدبة	Extensive featureless upland gravel plains
Dil'	دلع	Hill, usually smaller than a jabal
Dulay'; pl., Dulay'āt	دليع جمع دليعات	Diminutive of dil'
Fayḍah(t)	فيضة	Same as rawḍah
Hawr	هور	Marsh, lake
Jabal; pl., jibāl	جبل جمع جبال	Hill or mountain
Jaww	جو	Pronounced sandy-bottomed depression or basin with gentle slopes
Khabrā	خبراء	Closed basin with firm, flat mud and silt surface, commonly barren and lacking vegetation
Khawr	خور	Saline bay or inlet
Maḥaṭṭah(t)	محطة	Railroad station
Makhfar (Shurṭah)	مخفر (شرطة)	Police station
Nahr	نهر	Stream, river
Qal'ah(t)	قلعة	Fort
Qalīb; pl., Qulbān	قليب جمع قلبان	Well, spring
Qaṣr; dim., Quṣayr	قصر، قصيبة	Fort, palace, or castle
Ra's	رأس	Tip of cape or headland protruding into the sea
Rawḍah(t)	روضة	Closed basin with firm, flat, vegetation-covered mud surface, occasionally rocky and sandy
Sabkhah(t)	سبخة	Silt, clay, and sand flats, often with saline incrustation
Sha'īb	شعيب	Same as wadi
Shaṭṭ	شط	Stream, distributary
Wādī; pl., Widyān	وادي جمع وديان	Valley or dry water course

SOURCES OF BASE COMPILATION
A, compilation from published USAF Aeronautical Approach Chart 1:250 000 scale series and other published sources; B, reconnaissance ground surveys; and C, adjusted aerial photographic surveys supplemented by ground surveys. Topographic representation by L. F. Ramirez, Arabian American Oil Company

SOURCES OF GEOLOGIC COMPILATION
Geologic mapping by the Arabian American Oil Company, compiled by R. A. Bramkamp and L. F. Ramirez from aerial photography based on ground surveys by; A. Max Steineke supplemented by reconnaissance and detailed field work in scattered areas by S. B. Henry, A. B. Brown, J. W. Hoover, E. L. Berg, R. A. Bramkamp, L. D. Owens and others, and some later field work and photogeology by W. H. Reiss and S. J. Roach in the western part; and B, field work by T. F. Harris and J. W. Thomas

Scale 1:500 000

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