International Atomic Energy Agency

IUREP N.F.S. No. 127
November 1977
Distr. LIMITED
Original: ENGLISH

INTERNATIONAL URANIUM RESOURCES EVALUATION PROJECT

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NATIONAL FAVOURABILITY STUDIES

IRAQ

77-11164

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C O N T E N T S

S U M M A R Y

Iraq consists of a lowland trough lying between asymetrical and very different upland massifs to the east, north and west and continuing southeastwards to the Persian Gulf. The region is one of crustal weakness and subsidence with relatively young plastic sedimentary rocks engulfed in downwarped, ancient, rigid and highly resistant blocks.

Exploration in the 1954-55 period found some minor radioactive anomalies and very low uranium contents in limestones and phosphates. The results of an aerial radiometric survey in 1973-74 are not known to IAEA.

Iraq has no reported uranium resources but there are several favourable formations which warrant a detailed survey. In view of the size of the country and the small amount of systematic exploration carried out up to the present time, the Speculative Potential is considered to lie in the 1,000 to 10,000 tonnes uranium category.

A. INTRODUCTION AND GENERAL GEOGRAPHY

Iraq an independent country of southwest Asia and a republic since 1958, is bounded north by Turkey, east by Iran, southeast by the Persian gulf, south by Kuwait and Saudi Arabia, and west by Jordan and Syria. Its area is 169,284 sq. mi., or 438,445 km^2. In the north and much of the east, the frontiers follow natural features in difficult hill country with few routes. There is however one comparatively easy route via Kermanshah to central Iran. Toward the head of the Persian gulf the Iraq-Iran frontier is arbitrary, and the entire Shatt al Arab is included in Iraq. The western and southern frontiers are again arbitrary - straight lines drawn between a few outstanding natural features.

The fundamental elements in the physiography are the twin valleys of the Tigris and Euphrates rivers, joined in the south, but diverging in the north, separated by a tongue of higher land stretching southward from the Anatolian foothills to just north of Baghdad, and known as Al Jazirah ("the island"). Like Egypt, Iraq is very largely the gift of its rivers; and a consideration of both rivers is an essential basis to understanding the geography of the country.

Both rivers rise in the eastern highlands of Asia Minor, and pursue an intricate course southward around the numerous eastwest aligned mountain ridges. In places, earth movements and the emmission of lava have greatly affected their course.

It is possible to distinguish on a physiographic basis four major subregions in Iraq lower Iraq, made up of the twin lowland of the Euphrates and Tigris rivers; upper Iraq, the now separated river valleys with an intervening plateau zone; Assyria and Iraqi Kurdistan; and the western desert region.

Lower Iraq or the Lower Valley (sometimes referred to as the delta lowlands) begins at the ridge between Ramadi and Baghdad and extends about 350 mi. southward to the Persian gulf The Tigris and Euphrates diverge respectively east and west below Baghdad, which is therefore in a narrower waist of lowland. The Tigris has a particularly tortuous course.

From Ramadi southward the Euphrates flows at first in a well-defined channel, about 150-300 yd wide and of low season depth, 3-7 ft. Natural levees occur, as on the Tigris. Between Al Musayyib and As Samawah the river discharges into various distributaries, and in early Arab times formed one enormous swamp, with many present day remnant features, old channels, levees, cutoffs.

Away from the rivers patches of swamp and marsh occur with irregular ridges between. Parts are still largely uninhabited and unsurveyed. Along the river there is much variation in the quality of the land; some parts have infertile sands and gravels while others have alluvium and clay which when watered can be highly productive.

Upper Iraq - This comprises the valleys of the two main rivers, together with the tongue of irregular and somewhat higher ground which stretches southeastward between them as a prolongation of the Syrian steppe. At its entry into Iraq the Euphrates has cut a broad flat valley about 10-12 mile wide, and because of the absence of tributaries the sides are generally steep. Rejuvenation of the Euphrates led to many meanders being incised into the flat floor, giving a second set of terraces, with the river about 150 - 500 yd wide. Irregularities in rock strats have produced rapids and shoals. The Tigris on leaving Turkey has cut an irregular winding passage among low foothills and ridges; in places it runs parallel to the strike of these folds(mainly northwest-southeast) but elsewhere it cuts directly southward by narrow gorges through the hills themselves.

Between the Euphrates and Tigris, and bounded on the north by the Jabal Sinjar lies Al Jazirah, a region of undulating steppe small-scale fold ranges and closed drainage basins. The steppe continues into Syria and Jordan with the fold structures arranged in an arc running from west to southeast. The warping of the whole area has produced closed drainage basins, the largest of which is the Wadi ath Tharthar (a long defile running more or less parallel to the Tigris about 30 mi. farther west) which was important as a grazing area and is now part of the Tigris flood control project.

Assyria and Iraqi Kurdistan - Fronting the Tigris on the east between the Turkish frontier and the broad Diyala valley is an upland area roughly rectangular in shape which rises in steps eastward from river level. The first step is the Jabal Hamrin (1,600 ft), and behind it lies an undulating territory of river basins rolling plateaus and irregular hills which ultimately pass into the main Zagros range. The lower (western) part, broken by the valleys of the Great and Little Zab, is the ancient region of Assyria; farther east, as the mountain zone begins, there is an alternation of high ridges aligned northwest-southeast, with river basins between.

The plain of Mosul is drained mainly by the Great Zab and consists of irregular steppe rising from about 700 to 2,000 ft. A rich heavy soil made this plain the granary and centre of ancient Assyria. The zone between the two Zab rivers (central Assyria) is much less densely settled, partly because of the lack of good water; some springs are brackish and sulfurous.

In Iraqi Kurdistan, mountain ridges trend generally northwest-southeast, attaining 10,000 - 11,000 ft in a few places, with a summit average at about 8,000 ft. Between the ridges are trough valleys (often synclinal) usually occupied by rivers which have eroded out basins. All the streams weave a tortuous way south and southwest toward the lowlands, and are marked by gorge and defile sections where they skirt or cut through ridges. Remoteness and difficulty of access have hindered surveys and development.

Western Desert - Lying to the south and west of the riverine lowlands, this region extends from Kuwait and Saudi Arabia on the south as far as Jordan and Syria. The desert area slopes gently upward from the Euphrates lowland, and is formed of Cretaceous and Tertiary rock series, which are often exposed as irregular pavement. Differential resistance to erosion produces mini relief features, and there has been some small scale tectonic disturbance, hence the surface is by no means uniform or featureless.

Because of the simplicity and regularity of relief, Iraq has a straightforward climatic regime. In the lowlands two contrasting seasons occur: a dry and intensely hot summer (May-October), and a relatively cool, humid winter (December-March) with short transitional periods. In the mountain zones relief exerts a considerable effect, and winters can be moderately severe. From May onward the predominating element is the existence of a semi-permanent zone of extremely low atmospheric pressure, situated at the seaward end of the Persian gulf, and over West Pakistan. This draws in air from the northwest, which produces a very persistent and regular north-westerly wind (shamal) over the whole of Iraq. Coming from land areas, these currents are dry, and hardly any cloud forms, so that for several weeks or even months the sun beats down uninterruptedly, producing extremely high temperatures - July and August means are about 35°C (95°F), with mean day maxima up to 43° or 49° C (110° or 120° F). Some drop is apparent close to water surfaces because of intense evaporation, but the physiological effect is hardly improved because of higher humidity. Strong winds produce blowing dust or sandstorms; July is the worst month, with an average of five storms at Baghdad and eight at Ash Shu'aybah. No rain falls between May and October, the first onset beginning at the end of October, with January - February the wettest period.

During the winter season conditions are more variable . The main features of Iraqi climate are aridity and overwhelming summer heat, the difficulties of which are intensified by high atmospheric humidity locally near the rivers.

Originally the rivers provided most of Iraq's means of communication, but they are greatly declining in importance. The railway system (now operated by the Iraqi State Railways administration) gradually developed: of standard gauge from Baghdad to Mosul and (in 1940) connecting Syria and Turkey; and of metre gauge from Basra to Baghdad, and on to Kirkuk. This was an inconvenient system, and plans were made to extend the standard-gauge line to Basra and the metre-gauge line from Kirkuk via Irbil to Mosul, and to change over to diesel haulage.

Flooding restricted road development for a long time. In 1950 there were only 1,500 mi. of surfaced roads, the rest being of earth and impassable in winter. By the early 1960s more than 4,500 mi. of roads and tracks had been developed for motor traffic, which increased greatly. Air-conditioned buses operate to Damascus and most of the pilgrim traffic from Iran is handled by motor coach. There are international airports at Baghdad and Basra, and a state-owned airline operates within Iraq and abroad, with pilgrim flights to Jidda. Air, rail and to some extent road services are integrated by a state board.

B. GEOLOGY OF IRAQ IN RELATION TO POTENTIALLY FAVOURABLE URANIUM BEARING AREAS

Iraq consists of a lowland trough lying between asymmetrical and very different upland massifs to the east, north and west, and continuing southeastward as the Persian gulf. The region is one of crustal weakness and subsidence, with relatively young and plastic sedimentary rocks engulfed and downwarped between (on the west) the ancient, rigid and highly resistant block of Syria-Arabia and (east and north) the highly folded and topographically imposing younger Zagros and Anatolian mountain chains. The Zagros folds are mainly immense anticlines or hogbacks running from northwest to southeast with great regularity, and rising abruptly from the flat low-lying riverine plain. The Iraq-Iran political frontier follows this well-defined physical boundary for only about 250 mi; farther south, Iranian territory extends westward to include a stretch of lowland at the head of the Persian gulf, while toward the northeast the frontier swings east into the Zagros formation, thus including an extensive hill territory within Iraq. On the northwest and west, the land rises more gradually and regularly into the plateau of Syria-Arabia, which consists of a mass of Archean granites overlain by sedimentary layers, chiefly to the Mesozoic (Jurassic and Cretaceous) and Cenozoic (Eocene and Miocene) periods. Slight tilting or differential erosion have produced minor topographical features and the western edge of the Euphrates valley is in some places marked by a discernible cliff(iraq) from which the name of the country is said to originate. In the extreme northwest there are several small and gentle but clearly defined folds, which appear as ridges aligned more or less in an east-west direction, the chief of which is the Jabal Sinjar near Mosul.

C. PAST EXPLORATION

Until recent years no specific search for nuclear minerals has been made in Iraq, although uranium was one of the minerals included in the minerals exploration programme carried out by Site Investigations Co. Ltd. in 1954-56. In the course of that programme, an aerial scintillograph survey was made over a route Baghdad - Tharthar Lake - Wadi Tharthar - Kirkuk - Taug Bridge - Shari Lake - Baghdad. No anomalies of sufficient order were observed to suggest the occurrence of radioactive minerals.

In 1954-55 a regional Survey using a scintillation counter mounted in a Land Rover, was carried out over the major roads of Central and Northern Iraq. Such radiometric variations as occurred could be correlated to the geological features. A high positive anomaly located between Rawanduz and Rayat corresponded with outcrops of black carbonaceous shale, the radioactivity here being attributed mainly to the potassium content of the shale. Similar phenomena which occurred in a regional survey of the Southern Desert area were related to the potassium content of bitumen in which the radioactivity occurred. Further surveys over the Northern Desert and the Euphrates Valley revealed a number of radiometric anomalies, some over phosphate deposits and others over outcrops of Euphrates limestone. Analysis of 32 samples of Euphrates limestone showed uranium contents ranging from 0.001% to 0.011% U_3O_8 with two samples showing values of 0.056% and 0.076% respectively. The conclusion of the investigators was that these two higher values probably represented a radioactive horizon within the limestone but that the general concentrations were such that this was unlikely to prove of value as a source of uranium ore.

Investigations were next directed to the phosphate occurrences West of Rutba and in the area bounded by Rutba - Gur Aiyarat - Um Chaimin and the Jordan road. Radiometric anomalies indicated the presence of uranium being found to correspond to the higher values of phosphate. It was suggested as a conclusion that it might be practical to extract the uranium as a by-product of fertilizer phosphate. It was recommended by the investigators that further testing of the phosphates including drilling should be carried out and that the radioactivity of the Euphrates limestones, the bitumen deposit at Abu Gir, and the carbonaceous shales of Northern Iraq should be further investigated. These recommendations have not yet been carried out.

An aerial survey by Geometrics Ltd in 1973-74 covering 150,000 km^2 is listed by Geometrics but no information about this is available in IAEA.

D. URANIUM OCCURRENCES AND RESOURCES

Iraq has no reported uranium resources at this time and the only occurrences mentioned are those indicated in Chapter C above.

E. PRESENT STATUS OF EXPLORATION

In 1975 the Iraq Atomic Energy Commission asked the IAEA for technical assistance in a long term exploration survey of the sedimentary rocks in the country. This request was not fulfilled and there has been no further information of any planned activities in Iraq.

F. POTENTIAL FOR NEW DISCOVERIES

While Iraq has no reported uranium deposits at this time, uranium potential may be of the following types.

1) Stratiform, solution type deposits may be found in the Pliocene Age continental beds of the Bakhtyari formation of the Fars group. Mention is found of red continental conglomerates, sandstones and gritstone of this formation but no mention of carbonaceous trash.

2) Discordant deposits of veins, stocks and contact deposits may occur in both the Alpine fold belt associated with granites or metamorphics emplaced during several stages of orogenic disturbance during geologic time, and the desert southwest, the Arabian shield.

3) Although not probable, phosphorite deposits containing uranium may be found in the extreme north of Iraq belonging to the phosphorite belt adjacent to the Mediterranean depositional province.

Does this mean favourable for calcretes but no source of U.?

4) Also not probable are calcrete type deposits in the Syrian Desert. Maps indicate this is an area of closed interior drainage in a extremely arid climate favorable for formation of such deposits.

Despite the size of the country and the small amount of systematic exploration carried out to date the Speculative Potential is regarded as only fair and may be stated in the 1,000 to 10,000 tonnes uranium category

Compiled by J Cameron
IAEA
Vienna
October 1977

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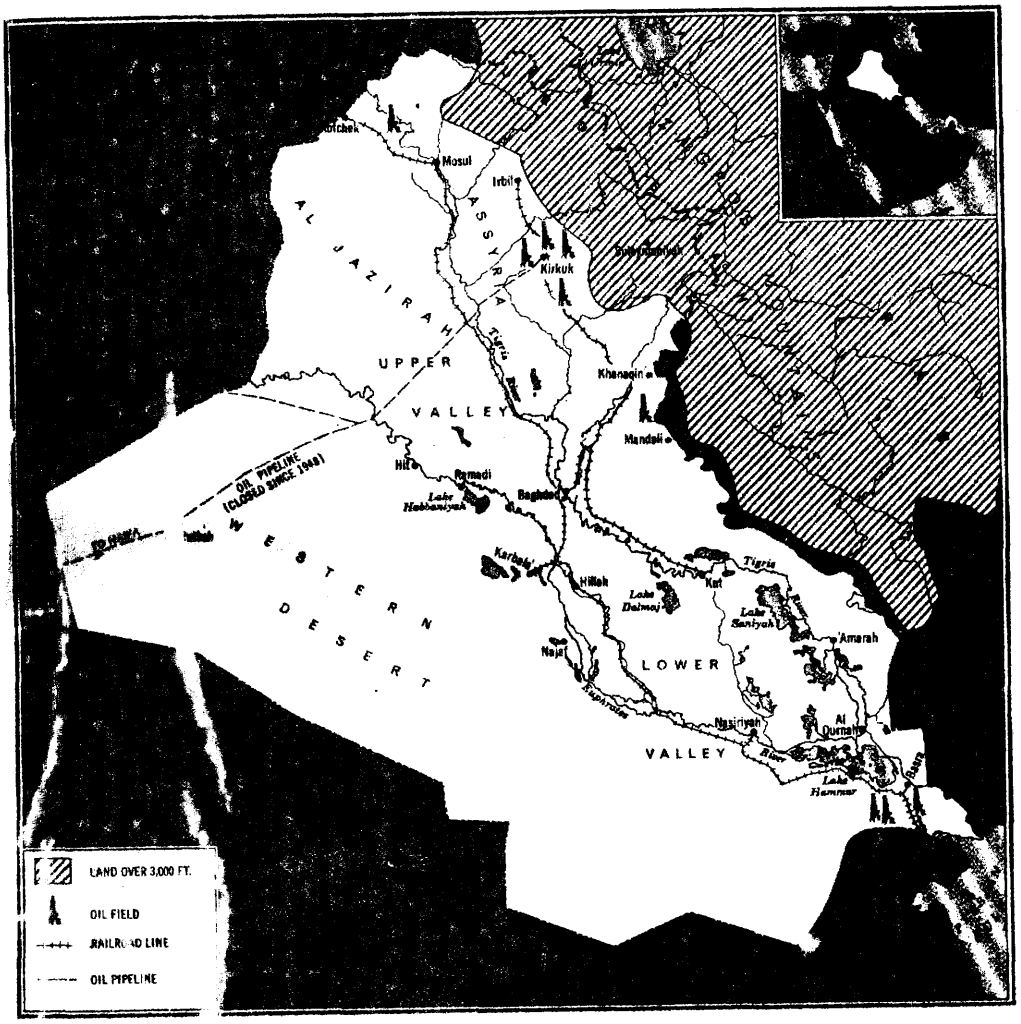
I found it very difficult to follow the geological description without a geological map.

Do you not think that this estimate is perhaps conservative?

(I would not, however, place it in Category I B as defined at last meeting).



PRINCIPAL TOWNS, OIL FIELDS, PIPELINES AND RAILROADS OF IRAQ