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GEOGRAPHY IN COLOUR

Oil in the Middle East

BY G. H. DURY and T. J. CHANDLER

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OIL IN THE MIDDLE EAST

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INTRODUCTION

Although the world's heavy industries and great transport systems were initially dependent on coal, mineral oil has become, in the twentieth century, a second major industrial fuel. The output and consumption of oil are increasing far more rapidly than those of coal. At the present time, some 1,725,000,000 tons of coal are mined and burned each year. The energy derived from oil is equivalent to that of 1,265,000,000 tons of coal a year. Other forms of power rank well below coal and oil - natural gas, despite its spectacular exploitation in recent times, supplies but the energy-equivalent of 420,000,000 tons of coal a year, and hydro-electricity, the equivalent of 240,000,000 tons. It should, of course, be noted that natural gas, like mineral oil, consists of organic hydrocarbons contained in rocks, and is usually raised in oilfields. When the energy of oil and gas are added together, the total is equivalent to 1,685,000,000 tons of coal - a figure little less than the world output of coal itself.

The relationship between consumption of coal and consumption of oil varies widely from one part of the world to another. In North America, the supply of energy from oil is greater than that from coal. Even so, too little oil is produced to meet the full demand, so that importing is necessary. In South America, oil is by far the chief source of power. In the U.S.S.R. and satellite countries, which form a self-contained economic system, output and consumption are evenly balanced, in respect both of coal and of oil; coal supplies three-and-a-half times as much energy as does oil. The countries of Western Europe rely principally on coal, which provides them with nearly three times as much energy as they derive from oil. But oil production in Western Europe is very small on the world scale, being equivalent to no more than 15,000,000 tons of coal a year. Oil sufficient to produce the energy-equivalent of 200,000,000 tons of coal a year must be imported.

Both the U.S.A. and the Western European countries, therefore, have vital interests in the oilfields of the Middle East. In Middle Eastern countries, oil production far exceeds consumption. Thus, although the Middle Eastern fields yield no more than 20% of the world's annual output of oil, they provide the great marketable surplus. Moreover, they contain some two-thirds of the world's proven reserves of oil. It is to be expected, therefore, that they will become still more prominent in the export trade, especially since reserves in the U.S.A. have been seriously depleted by past working.

In the ten years 1935-1945, production in the Middle East more than doubled, rising from some 11,500,000 tons to 27,000,000 tons a year. In the next ten years, 1945-1955, there was a six-fold increase, bringing annual production above 162,000,000 tons. Output is still rising.

NOTES ON PICTURES

1 Filling Station

The chief end product of the oil industry is fuel oil - diesel oil and petrol. As will be noted later, however, there is a multitude of other end products, some of which have encouraged the development of whole new industries. This picture is intended to symbolise the most familiar use of oil; any journey along a main road, busy with traffic and dotted with filling-stations, is enough to underline the fact that modern transport is oil-powered. So successful are road-vehicles that, in the United Kingdom, they carry more goods (in ton miles) than do the railways. In the U.S.A., too, the railways are experiencing damaging competition from road hauliers.

In addition, it should not be forgotten that air transport relies exclusively on oil, or that nearly all modern sea-going ships are driven by oil-fired boilers. Heavy industry increasingly uses oil power, and oil has proved an effective fuel in steel furnaces.

2 Map: Oilfields of the Middle East

As is well known, oil production in the Middle East is concentrated along the shores of the Persian Gulf and in the down-warped sedimentary basin which extends from the head of the Gulf towards the northwest. On one side of the great and complex basin run the fold mountains of south-western Persia; on the other lies the rigid crustal block of Arabia.

Political boundaries in this part of the world bear only the roughest of resemblances to the outlines of physique, and none at all to the limits of the oil-fields. But in practice they are of great significance. Would-be oil producers must negotiate with national rulers, and, at times, also with local rulers. Even when concessions have been obtained, further problems arise in moving the oil. With Europe and the U.S.A. as the main markets, oil must eventually be moved westwards. Pipelines running direct to ports on the Mediterranean must cross national boundaries, while oil shipped in the Persian Gulf normally goes through the Suez Canal.

Some of the political complexities of the Middle East have been noted in CGA:B575 The Middle East and CGA:B715 Life Among the Arabs; but for the sake of completeness, a few leading features ought to be emphasised here.

The greatest oil producing countries in the area are, at present, Kuwait (35% of the Middle Eastern total), Saudi Arabia (30%), Iraq (21%), Persia (10%), Qatar (3%) and Bahrein (1%). Kuwait is less than 6,000 square miles in area (about the size of Yorkshire) and has a population of 200,000. It is an independent Arab Sheikdom, ruled by a Sheik who receives half the profits made by the oil company. The company is jointly owned by British and American concerns. Saudi Arabia (about 1,000,000 square miles, and 6,000,000 people) emerged as an independent kingdom during World War I. Since oil was struck in 1938, American interests have become predominant in the oilfields of Saudi Arabia. Iraq (about 170,000 square miles, some 5,000,000 people) has recently rejected its monarchy and has become a republic. British and American companies in Iraq produce enough oil to provide the government of Iraq with £70,000,000 a year in royalties. Persia, since political disturbances of 1951, has lost ground as a producer of oil, and especially as a refining country, but its refining capacity still remains outstandingly large. More than 600,000 square miles in area, and with 2,000,000 inhabitants, it is an independent country ruled by a Shah. Control of oil production in Persia is exercised by a consortium, in which national and several foreign interests are represented. Qatar, an independent sheikdom, includes 8,000 square miles on a peninsula protruding into the Persian Gulf. Its 35,000 people are mainly nomadic or semi-nomadic. Oil revenues paid by British firms to the Sheik run, at present, at some £13,000,000 a year. Bahrein is a convenient title for an archipelago, with a total area of little more than 200 square miles and a population of 110,000. Production in Bahrein is in the

hands of an American company, which holds concessions from the ruling Sheik.

Even when nothing is said about the political relationships between individual Middle Eastern countries and the great industrial nations, it can readily be seen that Middle Eastern affairs are complex. French, Dutch and Japanese oil companies operate in the area in addition to those of Britain and the U.S.A.; the Suez Canal is controlled by Egypt, which has recently joined in a political union with Syria. Syria, the Lebanon, and Israel lie athwart the pipelines from the oilfields to the Mediterranean coast, and it is important to note that, although these three countries produce very little or no oil, they are in a position to prohibit the movement of the oil through their territories. The position is complicated, too, by the non-co-operation of the Arab states with the Jewish state of Israel. In the south of the Arabian Peninsula, Yemen, Aden, Muscat and Oman, and the Trucial States partake in the border disputes which afflict the whole of the Middle East. In the broad view, the area occupies a strategic position at least as important as its economic position.

3 Seepage of bitumen and oil, near Zakho, North Iraq

Natural hydrocarbons have been known in the Middle East for many centuries. According to the Biblical account, bitumen was used for caulking the Ark, and it was long employed in mummifying bodies in ancient Egypt. It was taken from sites such as this, where it seeps out at the surface of the ground. Bitumen is the heavy residue of mineral oil, which, being liable to vaporise, tends to form short-lived seepages. Natural gas, on the other hand, escaping in small quantities, gives rise to the perpetual fires of legend.

4 Geologist taking rock samples

Although seepages of bitumen and oil and fires maintained by natural gas give clues to the presence of oil underground, modern exploration relies heavily upon geological mapping. Much mapping is now done from air photographs (see Picture 7), but it is still necessary for field geologists to collect specimens of the rocks exposed on the ground. The essential equipment is a geological hammer and a haversack. Each specimen is carefully labelled at the time of collection, and taken back to base for further study. The general aim is to identify the ages of the rocks examined, and to determine their structure (see next two pictures).

5 Air view of eroded strata, near Jambur

Stretching away into the distance on the right, beds of resistant sandstone form steep-faced scarps which are cut by numbers of transverse valleys. In this dry climate, very little vegetation can grow. The rock structure is widely exposed to view - a circumstance helpful to geologists. It is obvious that the rocks dip uniformly away to the right of the view, but the steep edges curve round in the distance, bending back on themselves on the left. They form the resistant edges of an eroded upfold (see Picture 6). Note the position of the drilling rig on the left of the picture; the borehole is being sunk on the flank of the anticline. The reason for this is explained in the note to the next picture which represents this picture in diagrammatic form.

6 Diagram: Typical underground structure of oilfield

If the site of the borehole has been accurately selected, the drilling rig shown in the previous picture lies directly above the oil reservoir underground. In actuality, many boreholes fail to become productive, because it is very difficult to determine the precise pattern of underground structure, which are commonly far more complex than this deliberately simplified diagram suggests. Conditions vary greatly from one oilfield to another and even within the limits of a single field.

The diagram shows rocks up-arched in a gentle fold, which plunges downwards in the middle distance. Its rim of in-facing scarps is based on strong sandstones (shown black

in the picture), which are underlain by thick, impermeable shale. The shale beds prevent the oil from reaching the surface. Beneath the shale come sandstone and limestone. Both are permeable formations. The oil and natural gas, migrating upwards from the limestone, have collected in the pores of the sandstone and have been trapped in the top of the arch. The natural gas, being the lighter of the two, lies above the oil. It is likely to be under considerable pressure. In Middle Eastern oilfields, where there is little market for natural gas, drillers attempt to strike the oil direct. Thus boreholes are sunk on the flanks of folds, in order to by-pass the natural gas but to avoid entering the water which is usually found underneath the oil.

7 Air survey

Much of the most important exploratory work in oil geology employs the methods of geophysics - the study of the physical properties of the earth. Among the equipment are electronic devices designed for use in aircraft.

In the survey of oilfields, where metal ores are unlikely to be present, the main purpose of air survey is to provide air photographs showing structure and to record local variations in gravity, which help to reveal the presence, form, and amplitude of folds underground. In the location of ore deposits, however, the electro-magnetic detector is used. This sends a pulse from the primary aerials 300ft down into the ground. The return signals are picked up by the detector head towed behind and below the aircraft at the end of a 500ft cable. Electromagnetic detection can locate deposits of ores of nickel, copper, and zinc. The magnetometer, mounted at the tail of the aircraft, is used for detecting likely deposits of iron and titanium. Inside the aircraft is a scintillation counter, designed to detect radioactive ores. The various systems of electronic devices include special aerials mounted on the underside of the aircraft, which, in the form shown, is fully equipped for airborne geological survey.

8 Seismic survey

Seismic prospecting is another form of geophysical work. It takes two main forms - reflection survey (shown in the diagram) and the more complex refraction survey. In both, shock-waves are generated by the explosion of charges in shallow boreholes. For the sake of simplicity, only one shot is shown in the picture, but it is usual to detonate a whole series at any one firing, in order to give more information than can be had from a single shot.

The shock-waves travel radially into the ground, being reflected from the underground junction between two contrasted formations - here, the junction between shale and limestone below. (Additional reflections can be expected from junctions at greater depth, but these also have been omitted). The reflected shock-waves are picked up by geophones, each consisting of a moving coil poised in the field of a magnet, and are transmitted by cable to the recording van, where they are amplified, converted to very narrow rays of light, and simultaneously recorded on a broad strip of photographic film. When the film is developed and printed, the completed records appear as a series of graphs, one for each geophone. The graphs resemble graphs of earthquake waves, which indeed they are, although the man-made earthquakes are immeasurably less intense than great natural shocks.

Mathematical analysis of the record is somewhat complicated, but the principle is simple: the time taken for a shock-wave to reach the geophone, divided by its speed of travel through the rocks, gives the distance travelled. Allowance is made for the path of travel, so that the depth from the surface to the geological junction can be calculated. Repeated observations on a long line permit underground structure to be determined, even though there may be no trace whatever at the surface of the folds which exist at depth.

Reflection survey, therefore, indicates the forms of underground structures and the depths at which resistant formations occur. Refraction survey, in which shock-waves are made to travel along underground formations, enables rock-type to be inferred. Seismic prospecting is at its most effective where surface form gives little indication of structure. Where structure is closely reflected in relief, and where the ground is largely bare, stereoscopic air photographs are widely used.

9 Drilling rig in the Rumaila field

At this site, the search for oil has been successful. The initial survey by airborne prospectors, interpreters of air photographs and field geologists has been followed by exploratory drilling. Sand, bulldozed out of a broad trench, has been heaped into a rough dam enclosing a long, strip-like pool, which has been lined to contain the water used in mixing mud (see Picture 13). The water is brought in overland. In these early stages of development, there are no pipelines or storage tanks. All supplies, additional equipment, spares, food and water must be brought in as they are needed. It can readily be imagined that the drilling-in of new fields involves careful organisation of supply and maintenance, in order to overcome the severe environmental obstacles. It is one of the ironies of nature that large supplies of ore of the world's great natural resources are found in an area so dry and inhospitable as this.

10 Drilling: withdrawing pipe

Boreholes vary considerably in depth. Many, however, reach depths of thousands of feet, some going more than two miles down. Different types of drill-bit are used, according to the varying types of rock encountered below ground. In order to change the bit, the whole of the hollow drillshaft must be withdrawn. It is pulled up by means of a block, which raises the shaft far enough to reveal the junction between one 90ft length and the next. The lower section having been secured, the upper is unscrewed and stacked at the side of the rig. In this picture, the block is just being fitted in readiness for lifting. It is in order to leave room to manage the lengths of shaft that drillers need tall derricks.

Taken inside the base of a derrick at Atshan, this photograph shows the corrugated-iron sheeting which is necessary to protect the drilling crew from blowing sand.

11 Removing the drilling bit

When the whole of the shaft has been withdrawn, the drilling-bit emerges at the surface. The swinging final length of piping is steadied and fixed, and the bit inspected and, if necessary, changed, either because it is badly worn or because a different type of bit is required to deal with some different type of rock below ground. This close-up shows the end of the operation illustrated in the previous picture: the bit has been pulled up for changing. The large thick disc is the turn-table which rotates the drill-pipe. The pattern of bit shown is that most generally used: a bit with three toothed wheels set at an angle. As the shaft is rotated, the teeth grind away the rock at the bottom of the borehole.

Detached fragments of rock are carried away by the mud which is forced down the hollow centre of the drilling-shaft and returns to the surface between the outside of the shaft and the side of the borehole. These fragments are invaluable in helping the geologist to build up a picture of the underlying rock structure.

12 Determining salt content of an oil sample, Ain Zalah, North Iraq

Although the drilling site is apt to look somewhat informal, things are different inside the field laboratories, where highly developed scientific checking and testing are performed under strictly controlled conditions. The various liquids coming from the bore-holes are carefully analysed at all stages of the work. In this picture, a chemist is measuring the percentage salt content of samples of oil. A high salt content would suggest that the borehole has been sunk too near to underground water.

13 Mud testing at the Rumaila rig

In addition to bringing up the waste rock from the bottom of the borehole, the mud used during drilling helps to seal the walls of the hole, and to discourage caving-in when the drill is withdrawn. The quality of the mud is, therefore, of much importance. It is common practice, for instance, to mix large quantities of starch into the mud, in order to improve its sealing properties, and in any case, a careful watch must be kept of the changes in quality which occur during drilling. Here, the mud which has newly returned to the surface is being tested for density, by means of a beam-balance. The two small electric motors vibrate the screens over which the mud passes to the settling trough, before it is passed back to the top of the drilling shaft. On the screens, fragments of rock are separated from the fine grained mud. The most important information obtained from the mud relates to the types of rock encountered underground. Not only do the chippings indicate the presence of limestones, sandstones, or shales, but they can also show the geological age of the various strata. In the oilfields of the Middle East, rocks are dated relatively to one another with the aid of tiny fossils called foraminifera. These (known familiarly as 'forams') are revealed in microscope slides prepared from the mud reaching the surface. Examination of such slides is the task of a geologist.

14 Fitting a 'Christmas tree', Ain Zalah, North Iraq

If drilling is successful, and oil is struck, the borehole is cased and a complex array of branching pipes and control valves is fitted at the top of the casing. This array is known to all oilmen as a Christmas tree; one is being fixed here at a newly sunk well. In modern drilling, it is considered undesirable to allow oil to burst out as a gusher; the aim is to fix the Christmas tree at the earliest possible moment, so that the flow of oil can be fully controlled, and indeed prevented altogether until the well can be connected to a pipeline.

Although the ground is nearly bare and sky is cloudless (note the absence of cloud shadows) the oilmen are warmly clad. In Northern Iraq, well inside a large landmass, winter nights can be bitterly cold, and frequent frost occurs. Snow is by no means uncommon.

15 Wrapping machine on the thirty-inch pipeline

Nowadays, pipelines leading from wells to storage tanks or directly to refineries are frequently sunk in shallow trenches. The trenches are cut by powerful mechanical diggers. More machinery is used to lay the pipes, and to protect them with bituminised wrapping before they are buried. The wrapping machine, through which the pipe is passed, applies two strips of covering which overlap in continuous spirals. Speed of working is dramatic, the wrapping gang being able to deal with miles of pipe in a single day. Behind them rise clouds of desert dust - a sure mark of an arid climate. The fine particles are soon blown away by the wind, or settle again to the ground, where their very fineness protects them from stirring by the normal desert winds.

It is scarcely necessary to point out that pipelines have great practical and economic advantages in the transporting of oil, particularly in an area where roads and railways are little known.

16 Burning-off, Zubair

Disposal of natural gas emitted from oil bores is a serious problem in the Middle East. The simplest method of getting rid of it is to burn it, but burning, in the inflammable environment of an oilfield, needs caution. Here, at Zubair, is an extensive de-gassing station. The tall column on the right is a vertical separator; the gas separated from the crude oil is led away through long pipes to a safe distance, where it can be seen burning at the top of high chimneys. Such chimneys were formerly a usual sight on many oilfields, including those of Texas, but where there is a market for natural gas they are being reduced in numbers. One very recent

development (which may well affect some of the Middle Eastern oilfields) is the shipping of liquid methane produced, under pressure, from natural gas. Methane gas, of course, is the kind already on sale on containers for heating and lighting caravans and for similar purposes.

17 Process plant, Kirkuk

This general view of the installations at Kirkuk illustrates the typical form of the structures which have appeared in the oilfields of the Middle East. In a sense, the hugh shining tanks and the lines of piping seem highly incongruous against the background of desert; on the other hand, their austere outlines accord well with the flatness of many desert surfaces and with the unbroken distant sky-lines. It should be noted that space for building or for expansion presents few problems here, where population is sparse and the native economics feebly developed.

Spherical, rather than cylindrical, tanks, are becoming steadily more numerous, and to this extent the aspect of refineries and of storage installations is changing. Spherical tanks, ensuring container-resistance sensibly equal in all directions (and precisely equal in the case of stored gas) are preferable to the now old-fashioned cylinders.

18 Layout of oil refinery

Refining is far too elaborate a matter to be adequately described in these short notes. It is not possible to indicate the functions of all the installations shown in the diagram, but the principles involved can, perhaps, be usefully summarised. Crude oil, as it comes from the ground, varies widely in its physical properties from one well to another. It ranges considerably in density and in viscosity, and contains small but varying amounts of sulphur, and also, on occasion, of nitrogen and oxygen.

The first step in refining is distillation, which separates the various molecules in the crude oil according to the temperatures at which they vaporise. Separation is performed in a fractionating tower (shown on the left of the diagram). The incoming crude oil, heated by steam to about 800°F, is largely vaporised. It rises through holes in horizontal trays, losing heat as it goes, and condensing into fractions of progressively lighter density upwards. The trays are set at levels which correspond to selected differences in density - it should be noted, however, that the density-difference between one fraction and another is arbitrary; it is determined by the qualities ultimately required from the finished products. Thus, in the diagram, the fraction called bottoms will eventually become either residual fuels or bitumens. The lubricating-stocks fraction yields lubricating oils and waxes (see right-hand side of diagram); the gas oil fraction, on refining, is sold for use in diesel engines and heavy oil heating equipment; the kerosine (paraffin) fraction yields paraffin and jet-engine fuel; the naphtha fraction goes mainly for petrol, and the gas fraction is processed to yield raw materials for making plastics and for liquid gases and refinery fuel gas. Aviation petrol is derived partly from the naphtha fraction and partly from the gas fraction, the two parts passing through a blending station.

Today, distillation in the fractionating tower is merely one of a whole series of processes to which the oil is subjected in the refinery. Chemical changes are produced at various stages after fractionating has been carried out. Some of the most important of such processes occur in the catalytic cracking plant ('cat cracker') shown in the centre of the diagram. In the cat cracker, oil is processed in an atmosphere of hydrogen in order to yield high-octane petrol and additional quantities of light hydrocarbons.

The approximate percentage yield of the various products from crude oil are as follows:-

Petrols, 35-40; residual fuel, 28-32; distillate fuel (diesel oil, etc.) 16-18; paraffin, 4-6; and other products, 10-12.

Refining capacities in the Middle East bear no very close relationship to productive capacities. The present annual refining capacities are, in order: Persia, 25,000,000 tons; Saudi Arabia, 11,500,000 tons; Bahrein, 10,250,000 tons; Iraq, 2,250,000 tons; Kuwait, 1,500,000 tons. Compare the several outputs mentioned above with those in the notes to Picture 2.

19 Workers' houses at Kirkuk

The striking upsurge of the production of oil in the Middle East has been followed inevitably by equally striking changes in the local scene. Notable among such changes are the appearance, not only of oil installations proper, but also of new residential buildings constructed by the oil companies. These workers' houses at Kirkuk would not look out-of-place in Western Europe or in North America, although they are obviously better adapted to the sun of Iraq than to European cloud and rain. Modern architectural designs strongly resemble, by coincidence, the square-walled and flat-roofed dwellings which are traditional throughout the dry regions of the Middle East. But although the houses, and even the shutters on the windows, look occidental enough, the gardens and the lawns are obviously incongruous; they are, moreover, maintained with difficulty in this dry land. Compare the struggling grass of the lawn with the bare surface of the arid land adjoining.

20 South Gate, Baghdad

It cannot be denied that the revenue from oil has provided Middle Eastern rulers with immense personal fortunes. On the other hand, some states are putting vast sums into public works and public service. Iraq is an excellent case in point. A Development Board, established in 1950, has allocated to it 70% of national oil revenues - i.e. 35% of the profits from oil raised in Iraq. Major national schemes are in hand to improve agriculture, irrigation, roads, and industry. Consumption of electricity in Iraq trebled in five years. In the same period, the number of school children nearly doubled, and the rate of new building nearly trebled. The effects of new building are well exemplified by this view of South Gate, Baghdad, which now bears no resemblance to a scene from the legendary Arabian Nights. In Saudi Arabia, too, progress has been made. In 1933 its annual income was but £600,000 a year; the last ten years it has received £700,000,000 in royalties from oil. The Saudi-Arabian settlement of Riyadh has grown from a small town, enclosed in mud walls, to a well laid-out city of 200,000 people, with a new royal palace and a university.

21 Main Square, Kuwait

Similarly, transport in parts of the Middle East has greatly changed since the days of camels, pack asses, and porters. The number of private cars in Iraq trebled in the five years 1951-56, and the number of heavy transport vehicles rose by 50%. This noonday scene in Kuwait (note the time on the clock, and the short shadows) includes numbers of large modern private cars - perhaps the most evident signs of the changing economy. The buildings in the background are assorted, with arcades in the traditional style side-by-side with recent constructions.

22 New industrial area, Kirkuk

It is only thirty years since the Baba Gurgur Well No. 1, the discovery well of the Kirkuk oilfield, came in as a gusher. Since that time, not only has the Kirkuk field become a great producer, with more than forty high-yielding wells, but a whole new industrial town has grown up. A population of 20,000 has expanded to 125,000, many of whom earn their living directly, or indirectly, from oil. 200,000,000 tons of oil have been produced from the Kirkuk field; one well alone (No. 5) has yielded more than 10,000,000 tons. The expanding industrial district - very largely concerned with the handling and processing of oil - is dominated by the two cooling towers of an oil fired power-station.

23 Fixing the sea-line on tanker, Banias

Oil for export, whether crude or already refined, is transported by tanker. In the early days, tankers lay offshore to load, whether in order to reduce the risk of fire or simply because (as in the Gulf of Mexico) the sea was very shallow. Nowadays, with new tankers in the range of 80,000 tons and upwards, it is more than ever necessary for tankers to load at a distance from the shore. Flexible pipes are run from the storage tanks onshore to the vessels, and are manhandled into position as shown in the picture. They are attached to the inlets of the tank compartments. Note the line of projecting pipes on the left.

24 Oil derricks at the Queen Elizabeth Dock, Manchester

In the great importing countries, it is usual to find more elaborate harbour facilities than in exporting countries. In the post-war period, new harbour installations have been, or are being, built at Finnart on Loch Long and at Milford Haven; sites selected as giving deep land-locked water close inshore.

Finnart is designed merely for off-loading, the oil being piped to Grangemouth to be refined. But all the large British ports are equipped to handle imported oil; here at Manchester the tankers do not come alongside, but discharge oil through pipes corresponding to the pipe shown in the previous picture.

With increasingly large markets for the complete range of refinery products (see also next picture), refining is tending to expand in countries importing oil - particularly in Great Britain, where refining capacity has expanded in the post-war period much more rapidly than consumption.

25 Petrochemical industry

Industrial chemistry using oil as a raw material is fast growing as elaborate and far-ranging as the industrial chemistry which depends on coal. It is generally well-known that the by-products of gas production go to the making of a vast series of dyes and medicines, but it is not yet realised how advanced petrochemistry - the production of substances from mineral oil - has already become.

As a group, the products of the rising industry can be called polymers - synthetic plastic materials, with physical and chemical properties which are highly desirable both in the home and in industry. The selected picture shows a factory worker inspecting a sheet of coloured plastic. This particular material is available in a hundred different colours and a useful range of thicknesses. Developed from transparent plastic used in cockpit covers for aircraft, it is now consumed chiefly in the lighting, automobile, radio and television industries. The extraordinary synthetic fibre 'terylene' is another of the impressive products of petrochemistry. In the hundred years since the first oil well was brought in (the Drake Well, Pennsylvania) mineral oil has revolutionised transport. It now promises, in addition to effecting profound changes in industry in general, to alter the whole appearance of domestic interiors and to bring about dramatic re-organisation in the textile industry. There is no reason to suppose, moreover, that the possibilities of oil have yet been fully explored.

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	Statesman's Year Book	Annual

Also, publications of the Petroleum Information Bureau

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