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REPORT

ON THE

DESTRUCTION

OF

ROUMANIAN OILFIELDS.

BY

LIEUT-COL. J. NORTON-GRIFFITHS, D.S.O., M.P.

JASSY,

22nd January, 1917.

(B17/129) 50 2/17 H&S 4195wo

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From Lieut.-Colonel Norton Griffiths.

To the Director of Military Intelligence, War Office, London.

Jassy,

22nd January, 1917.

I have the honour to submit my report on the destruction of the Roumanian Oil Industry, which, I hope, will be found to confirm the various cables sent you through His Majesty's Minister, Sir George Barclay, and the Military Attaché.

On my arrival I found that the military situation on the north-western frontier was very precarious. Large enemy forces had broken through the Jiu and Olt passes and were rapidly pushing south.

My first efforts were directed to satisfying my own mind as to the possibilities of the Roumanian Army withstanding further enemy attacks. After seeing various general officers commanding, I came to the conclusion (although much optimism prevailed) that the equipment of the Roumanian Army—their gunnery and machine-gun power in particular—were such that the enemy, with his superior guns and tactics must—up to a point—and for a time, anyhow—have things, more or less, his own way, particularly towards the oil regions.

The first few days had to be spent in interviewing various authorities and in obtaining the necessary permits to move in military zones and elsewhere. Our Military Attaché was away with the King and was not available till the 22nd November.

Every effort to get any means of locomotion was flatly refused and that which I eventually got to carry on with was from private sources, for which your appreciation is due to both Captain Prince Bibesco and Mr. J. Chrissoveloni.

Shortly after arrival on 23rd November, a Government Commission for destroying petroleum was appointed, consisting of Roumanians and French, and it was suggested that I should be a member, but as I foresaw that it might tie my hands in the future operations, I decided, diplomatically, to keep clear of it. It soon became evident to me that the working of this Commission would be too slow to meet the enemy movements effectively.

To be sure of making a success of the destruction of one or the other—corn or oil—I decided to supervise the latter personally. The enemy, by this time, was already in possession of the rich grain area, west of the Olt river, and was making a direct advance towards the oilfields. Indeed, the position was such that anything approaching complete destruction of the industry seemed impossible.

In contra-distinction to the then prevailing ideas of the Roumanian authorities, I decided to run all risks of total destruction, if possible, in the first threatened areas, though quite realizing the bitter attacks which would be made in the event of the enemy not occupying the areas in which such acts were committed. My principal enemy in this respect was the Roumanian optimism, both in military and government circles.

With a view to dealing simultaneously with the corn position, I instructed Captain Pitts to direct his energies and those of his staff in this direction. This effort, together with the obstacles encountered almost at every turn in the destruction or removal of corn, will form the subject of a separate report, as I desire to confine this to the destruction of oilfields and refineries, together with stocks, and the installations for power, electric light, water, workshops, gas, stores, timber stocks and all the paraphernalia of an oil industry.

On the 25th of November, 8 days after my arrival in Bucharest, the crossing by the enemy of the Danube, following that of River Olt, decided the Roumanian Government to evacuate Bucharest. The British and other Legations and their staffs followed on the same day. Before the British Legation left, I again discussed the work of my mission with His Majesty's Minister and the Military Attaché, and it appeared evident that Sir George Barclay was faced with overwhelming opposition by every member of the Roumanian Government. Any concession which the Government has since made must be attributed to the untiring efforts of the British Minister in this respect.

During the period of the evacuation of Bucharest enemy aeroplanes were flying with impunity all over the country, bombing Bucharest and other important centres. This added to the general confusion and made it almost impossible for the Government or military authorities even to consider any suggestion in connection with my mission.

With a view to taking all possible precautions, I cabled to you suggesting direct negotiations with the Shell Trading and Transport Company and asking to be placed in control of their interests. My reason for doing this at that time was that it appeared hopeless to expect any definite decision on the part of the Government or the Government Commission. I may here mention that the Astra Romana Company, in which the "Shell" has something approaching, if not an actual, controlling interest had been trading with the enemy up to the time of the entry of Roumania into the war, having been selling something from one to two thousand tons per day by direct consignments to the enemy. I shall attach or forward later, a diagram-illustration showing the rather involved British interests in this concern.

In the meantime I had opened negotiations with Mr. E. J. Sadler, of the Standard Oil Company, who was always most courteous although he felt keenly the possibility of destruction of an undertaking which he had so ably developed since its inception. This concern and the Astra Romana would have placed me in control of half of the Roumanian Oil Industry. These negotiations may possibly have influenced the Government to come to some definite decision, for, on the evening of the 24th November, I learned that they had issued through the Government Commission instructions to begin the destruction of stocks, and it, therefore, became unnecessary to develop further negotiations with these two companies.

I proceeded to Ploesti, the most important oil centre of Roumania, and at once enlisted the services of certain British oil engineers, who, in due course, were granted the King's commission. There were others whom I wanted, but I was limited in this respect both as regards my transport and their equipment.

It was my original intention to check all the stocks of oil and products at the various refineries and fields, and also to inventory the plant likely to be destroyed, but I found that there were quite 1,000 reservoirs and a vast amount of plant, together with 2,000 wells, scattered over an area exceeding 1,000 square kilometres, so that it was obviously impossible to check all the figures in the short time which I judged was still available. I decided, therefore, not to delay the more important work of destruction (the enemy had apparently made up his mind not to allow time for this), and to risk the collection of data at a later date. As it was, the accomplishment of the actual work of destruction required the continuous and untiring efforts during day and night of the small party.

On the morning of the 26th November I drove out to the town of Tergoviste, which was in the most threatened zone and where several important refineries are situated. Here I met the Roumanian Government Commission for the first time. They were considering the means of destruction. They informed me that they could not accede to *any* of my demands extending beyond those of firing the stocks of oil. These they had decided (with a view to preventing fire and greater destruction) should be run off by means of trenches upwards of a kilometre into prepared dams, a task which in itself would have taken some two months considering the large stocks on hand. This scheme was both farcical and useless. I protested that this was absolutely inadequate, and demanded total destruction not only of the stocks but also of the plant, machinery, reservoirs, and shops as well. This they refused to agree to, but I ordered my party to carry out the work, as I understood it, and as in my opinion it was the only plan consistent with the general scheme outlined by you. From further conversations it became quite clear that the Commission, in forming its plan of destruction, had in view the possible quick re-occupation by Roumanian troops of the lost territories, and, consequently, wished to burn only the stocks at a distance from the refineries and plant, so that the latter should not be damaged, and to remove or hide such essential parts as would impede the enemy working the refineries. The same scheme was to be applied to the producing fields where the superstructures were not to be fired, and the plugging was to consist only of the lowering down the wells of a certain form of tube which could be extracted later on. The form of this tube was to be kept a secret—a secret which was already public property.

I took cognizance of these facts and in vain tried to point out that all the refining machinery parts which could be removed could easily be replaced by the enemy, more especially as nearly all were of German origin, and, further, that the tubes which they intended to lower down the wells could easily be extracted. I also tried to impress upon them the fact that, when the enemy was forced to retire, he would take good care to destroy everything that was likely to be of military value. However, in order to avoid local friction, I wired to General Iliesco, the Chief of the Staff, submitting that the proposed military object would certainly not be achieved unless total and radical destruction was agreed to, urging upon him the necessity of not limiting me to any particular form of

destruction, and adding that I should have *carte blanche* in adapting any suggestion which I thought necessary. At my request the Government commission also wired for a clearer rendering of General Iliesco's instructions to them, but no answer was received. Lieutenant Philippon, my French colleague, a member of the field section of the commission, also wired at my request to General Berthelot to press the Government for total destruction.

In the meantime, preparations were hastened for the firing of the Tergoviste refineries on the lines I had suggested. Here in my first effort I had the good fortune to have the invaluable co-operation of the British element I found there, and your appreciation is due to Mr. William Guthrie, the manager of the Roumanian Consolidated Oilfields refinery at Tergoviste, who was arrested during his patriotic efforts to assist. He was, however, released immediately and apologies were tendered.

I.—TERGOVISTE—The following refineries were destroyed:—

1. ROUMANIAN CONSOLIDATED OILFIELDS, LIMITED.—This refinery had a working capacity of 350 tons of crude oil per day. Storage capacity 35,000 tons, distributed over an area of 14 acres. It contained a battery of 6 stills, with ephlegmators and preheaters, refining and rectifying plant, electric light installation, 120 h.p. boiler plant, workshops and stores. Stocks in reservoirs when fired, 18,000 tons.

The preparatory measures taken for destruction were as follows:—

- (a.) Dams were built round each reservoir.
- (b.) Channels were cut from storage tanks through the refinery to the large reservoirs.
- (c.) Communication trenches were cut to the various buildings containing plant.
- (d.) All machinery, including lathes, motors, &c., were smashed by sledge hammers.
- (e.) The laboratory was demolished by sledge hammers.
- (f.) All reservoir valves were opened and the oil allowed to flow into the dams surrounding the reservoirs and along all the communication trenches and ignited, burning and exploding the reservoirs and constantly feeding the trenches; these led to the plant and machinery and thus helping complete destruction.

This refinery being situated in the immediate vicinity of the railway station, through which divisions of infantry were retreating, special precautions had to be taken in order not to interfere with their only line of communication. At the last moment, and just before firing, the local General Commanding sent definite orders not to fire, he being influenced by the prevailing belief that the ensuing explosions would wreck the town and cut his rail communication. No heed was paid to these orders (beyond sending word that I would guarantee their safety) and before we could be stopped the refinery was blazing. Neither the town nor the station suffered.

2. HAIMAN.—A small, old refinery recently enlarged to a working capacity of 35 tons per day. Storage capacity, 3,500 tons, distributed over an area of about 1½ acres. Contained 3 stills, refining and small rectifying plant. Stocks in reservoirs when fired, 2,000 tons.

The preparatory measures taken for destruction were as follows:—A large dam was built outside the refinery and a trench cut to the storage tanks, which were inside the refinery. The valves of the reservoirs were then opened and the oil fired which wrecked both reservoirs and refinery, as well as firing the surrounding installations. It was here that the first work of the Roumanian Commission was seen to consist of an uphill gradient resulting in the flooding of the refinery. This was most suitable to us, as it was intended to carry the oil away in the opposite direction and so avoid wreckage of the refinery.

3. GRIGORESCU.—A small refinery recently enlarged to a working capacity of 60 tons per day. Storage capacity, 4,000 tons, distributed over an area of about 2½ acres. Contained stills, refining and rectifying plant, all fairly old. Stocks in reservoirs when fired, 1,300 tons. The refinery was situated immediately on the left bank of the River Jalomita. The authorities feared the escape of oil down the river, and a special dam had to be built round the refinery before it was fired. Ditches were carried into the workshops and pump-houses, to convey oil for firing purposes, after pumps and all machinery had been smashed with sledge hammers. The oil was then fired and the reservoirs exploded, firing the adjoining buildings.

4. AURORA.—A very old and obsolete refinery, originally owned by a Dutch concern but now controlled by the German Steaua Romana group who some years ago advanced the Dutch Company an important sum of money on mortgage, which is not yet redeemed. Working capacity, 100 tons per day. Storage capacity, 6,000 tons. It was equipped with a small lubricating plant, but all the machinery was old and the buildings in a state of ruin. The refinery contained stocks of 2,780 tons, of which 780 tons were lubricating oils. In view of avoiding the possibility of exaggerated claims for compensation I decided not to fire, but to run off the oil, allowing it to percolate into the ground, and wrecking machinery of any value. I ascertained, however, the following night that the refinery and dams had been fired by the rearguard of the Roumanian Army as it passed.

All these fires lasted several days, the smoke hung heavily over the town and the flames, which at times rose to great heights, illuminated the neighbouring districts, thus allowing the enemy for the first time to become aware of our work. In the meantime, the enemy were making rapid progress in the vicinity of Dragoslavele (which lies north-west of Tergoviste) and they were also threatening Ploesti, in our rear, from the south.

The roads were now becoming impracticable with the passing of the refugees and the retreat of the Roumanian convoys. The traffic was held up for hours at a time, causing us serious delays in our movements and, on several occasions, it was necessary to take over its organization.

II.—OCHIURI RASVAD.—This oilfield, lying immediately east of Tergoviste, was our next objective. It is a new field. The present producing area is entirely owned by the Astra Romana Company, who had 3 producing wells yielding about 180 tons of oil per day and 7 drilling wells (*i.e.*, sinkings to oil).

In addition to this Company the Steaua Romana owns 2 drilling wells.

This field produces from a depth of from 380 to 450 metres in the Dacian formation, which is covered by Levantine beds. One water source of importance has to be shut off before running into the oil sand and the average time required for completing a well is six months. All the drilling here was done by the Canadian system, and none but Canadian tools were found on the field. The average time indicated for drilling a well presupposes the existence of all necessary installation, tools and power, as well as skilled labour plus local knowledge of the formation. Without these essentials experts agree that at least double the time is required and it can be safely assumed that new wells cannot be drilled in a shorter period.

These were the first wells encountered, and my object was to plug them—burn the oil stocks and stores, and to destroy by hammers the workshops and plant. It was a noticeable fact that even a small field such as this, was equipped with large numbers of steam and belt pumps, large electric motors and steam engines and a vast amount of drilling, fishing and bailing materials and tools.

The plugging of the wells was commenced and the following course adopted:—Producing wells (by bailing).—Bailers were dropped down together with their wire lines (from $\frac{7}{8}$ -inch to $1\frac{1}{4}$ -inch diameter), which were released from the drum and allowed to "run away" and drop to the bottom of the hole. On top of the wire line (always about three or four hundred metres in length) other available tools were dropped in inverted form which jammed further down the wire line. The tools dropped from the top of the holes consisted of bits of the same diameter as the casing, varying from 6-inch to 12-inch fishing hooks, tool wrenches, pulleys, iron bars and bolts, which would pack and jam in between the bigger tools. In addition, small material in the way of brass fittings (babbit metal, copper, tin, and small connecting joints) were also thrown down the holes. After this we smashed the engines, pulleys, and other vulnerable parts in the derrick which was then fired. Every producing well was dealt with in this way. It should be stated that the production on this field was obtained by bailing—there were no natural flowing wells.

Should the enemy attempt to produce from these wells he will first have to build new rigs and derricks, procure the necessary power fishing and bailing tools as well as ropes and belts, and then proceed with the unplugging of what to him will be an unknown quantity. It is a well-known fact that if, by mischance, in the ordinary working day of an oilfield a tool escapes down the hole in the manner dropped down by us it would take a considerable time to extract it in spite of the knowledge at hand regard dimensions. Therefore, having proceeded as we did, by dropping a large number of tools down the holes and wedging them with small fittings, it can safely be said that unplugging will be most difficult and generally speaking impossible.

Where the oil level is high it might rise above the tools dropped in the holes, but this supply would be exceedingly small and only temporary, as the oil sand which rises with the oil will settle and quickly block the spaces between the tools in the casing.

Drilling wells.—These are wells at various depths in the course of being carried down to the oil strata. They were plugged and generally dealt with in the same manner as the bailing wells, with the difference that, having holes of greater diameter (i.e., from 8-inch to 22-inch) large calibre tools were used for plugging. Before the work of drilling (in view of reaching the oil source) can be continued, all these tools must first be fished out—a procedure which will be most difficult and in most cases impossible.

STOCKS OF OIL.—The smaller deposits in wooden measuring tanks near each well were fired separately with the wells and the larger iron reservoir (after dams had been built round them) were emptied and fired, the reservoirs exploding soon after.

MACHINERY.—The pumps mounted in various parts of the field were destroyed with sledge hammers, particular attention being bestowed on the piston rods, cylinders and all cast iron parts. The lathes found in the shops were smashed, together with all gear wheels and leading screws. The iron parts of drilling machines were bent, castings smashed, and a number of spare bailing machines were demolished. Subsequently the sheds were fired, thus completing the damage.

STORES.—In most instances these were wooden structures, and after removing all brass and copper fittings (which were thrown down the wells) and destroying spares, they were then completely gutted.

The description of the damage done to the refineries at Tergoviste and the wells at Ochiuri Rasvad also applies to other fields which will be mentioned, and where the work done will only be briefly described.

III.—MORENI.—On the morning of the 27th November I visited this district. Here the Government Commission, after the interview I had had on the 26th November, made some attempt to carry out my instructions, but in every instance their efforts were totally inadequate.

This field is the largest producing one in Roumania, covering an area of about two thousand acres. It has been developed on modern lines and was equipped with first class plant machinery and well designed workshops. The locality is a town in itself, and the sight of it made one feel the hopelessness of the task which had to be accomplished, and had it not been for the presence of the British element the work would have been virtually impossible.

It was here we encountered flowing wells highly charged with gas, so much so that the ordinary workman trembles at the idea of even a match being lit anywhere in the field—an offence punishable in normal times by imprisonment.

The development here commenced in the year 1904, on the right bank of the river Cricov, at the places known as Stavropoleos and Tuicani, where excellent results were obtained. Wells at the shallow dept of 250 metres yielded 200 tons daily by bailing. At 430 metres larger sources were encountered and flowing wells were brought in, yielding from 300 to 700 tons daily. At 600 metres an even more prolific sand was struck and one particular, well known as the "Colombia," produced from this source 400,000 tons. A large number of other wells produced over 100,000 tons, and were still producing from the 600 metre sand when they were destroyed. Deeper sources were also reached at 800 metres and these were in the course of development. Difficulty was anticipated in rendering useless flowing wells and it will be of interest here to record that I am able to state that one of the strongest flowing wells, belonging to the Romano-Americana Company at Moreni, was so completely plugged that the flowing oil burst up between the casing and appeared oozing through the earths surface at various points surrounding the wellhead where it was ignited. It is believed that the oil will block itself and cease from this ooze.

In 1910 the eastern side of the river Cricov, which intersects the oilfield, was also developed and rich oilsands were met with at 300 metres yielding from 20 to 30,000 tons of oil per well. This source became exhausted and, in 1913, a new sand was discovered at 760 metres yielding a flowing production of from 300 to 600 tons per day. The flowing wells at the time of destruction were producing between 60 and 100 tons daily.

This field consisted of 112 producing wells and 72 drilling wells with a daily production of 1,650 tons owned by 19 companies and private owners. Since Roumania's entry into the war, however, the production fell considerably owing to lack of material and labour.

With a view to impressing the Roumanians I appealed to the representatives of the main British interest in Moreni (the Roumanian Consolidated Oilfields) that they should set an example of what complete destruction really meant, and their action in this direction materially assisted operations elsewhere. Whilst performing their duties, attempts were made to arrest them, and I had to use most emphatic language to the head of the Government Commission on account of his abusive conduct towards my party. This incident ended satisfactorily for me and enabled me to redouble our wrecking tactics without fear of interruption.

On the morning of the 28th November I returned to Moreni, met the Government Commission again and visited the field where I found them running off the stocks of oil with a view to firing it at a safe distance in previously prepared dams. Some of the reservoirs had, unfortunately, already been emptied, and for this reason *many of them could not be wrecked and were left intact*. It was here also that this action—had it not been for our intervention—would have been attended with serious consequences. Two masses of floating oil caught fire on the river (each about 600 yards in length) and were drifting down towards the two main wooden bridges over the Cricov river, on which the army relied for the passage of their men and guns from Dambovitza to Prahova. Our combined efforts, and those of a considerable number of passing troops, were required to prevent the oil reaching the bridges in question.

I insisted again on the necessity of retaining the stocks on the fields and firing it on the spot, amongst the shops, plant and stores, and thus utilizing it for the general purposes of destruction. The Government Commission refused to consider the question of firing until they received the definite instructions for which they had wired. Time being of great importance I despatched one of them to General Headquarters, and also asked Colonel Thomson to use his influence in getting the proper instructions sent out.

The 29th of November was spent in completing the preparations for firing Moreni, and the messenger whom I had previously despatched to General Headquarters returned with satisfactory instructions.

Large gangs of men were employed with sledge hammers and other tools demolishing every conceivable piece of machinery, and even the breakable spares in the central stores. The wells were again visited and further plugging was carried on. On the evening of the 30th November it was obvious that the Roumanian Government Commission were still bent on blocking tactics and intended to postpone the actual firing, and it was here that I instructed the small British staff (whilst I was arguing with the Commission) to commence the firing of the derricks and their adjoining machine houses.

The greater work of firing the oil reservoirs, store houses, power plants, workshops, gas and water installations, casting furnaces, and other plant necessary to a big industry commenced the next day. Several large explosions which resulted left the field clear of the native human element, and, consequently, we had no further obstructions. One of the surprising features was now, in the midst of surrounding conflagrations, some of the plant remained intact, and the whole night was spent in working round and into such areas, which were always difficult of access owing to the fire and heat. The trails of straw saturated with oil and laid for the purpose of communicating fires were found to have been rendered ineffective through a heavy storm. It was here that the greatest fire risks were encountered, and it was only by a miracle that two of the mission were not trapped. Captain Prince Bibesco (the Roumanian officer who was attached to me) particularly distinguished himself, and it was entirely due to his prompt action that one of your officers escaped. In the Bana region, on the left side of the valley, Lieutenant Hayward also had similarly unpleasant experiences, and caused me considerable anxiety. The quantity of oil burnt in this district was 42,000 tons.

While this work was proceeding I detailed Captain Masterson (who had commenced to work with me in this field) to follow up and complete the destruction of Ochiuri Rasvad and Gura Ocinitza.

Up to this moment the military authorities considered as dangerous only the zone west of the Prahova river, but it was quite evident that further immediate preparatory measures were required also for the fields east of the river, and I despatched Lieutenant Simpson at once to carry out and complete the necessary work.

IV.—**FILIPESTI DE PADURE.**—This field is situated between Moreni and the River Prahova and was discovered in 1911. The oil is rich in paraffin and is encountered in the Meotie formation at depths varying from 1,000 to 1,100 metres. The few wells on this field were scattered over a wide area. There existed 7 drilling and 2 producing wells owned by 5 companies. Effective plugging was carried out, as was the work of destruction, similarly to that adopted in the other fields. The stocks of oil amounting to 20,600 tons were also fired around the reservoirs completing the wreckage. This was the last field to be fired on the west side of the River Prahova.

V.—**PLOESTI.**—On the 3rd of December orders were given to release all residues and lubricating oils from the Ploesti refineries, but, although the position was so precarious the General Commanding the Roumanian armies around Ploesti, probably influenced by local civil pressure, refused to allow the letting off of the benzine, so that, for the time being, I had to content myself in dealing with crude oil and residues and the general preparation for the 15 refineries and deposits in and around Ploesti.

The general position east of the river Prahova was rapidly becoming precarious, and only after having continuous pressure brought to bear on headquarters was I able to obtain sanction for complete destruction on this side of the valley. On the afternoon of the 4th December a telegram to this effect was received from General Averesco by Colonel Coanda, the Prefect of this district. As the enemy entered Ploesti between the 6th and 7th December, it will readily be seen how much work had to be accomplished in the small space of time available, there being over 400,000 tons of crude and products, and very extensive plant and machinery in this town alone.

It was perhaps fortunate that continual preparations were made for destruction during the time I was pressing for definite powers, as otherwise it would have been impossible to effect the complete destruction on which I had repeatedly insisted and which I am now able to report was carried out *ad finem*.

Local obstacles having been overcome and houses evacuated in the vicinity of refineries, the work of destruction commenced. The following were the properties dealt with :—

REFINERIES—

- 1.—AQUILA FRANCO ROMANA.
- 2.—ASTRA ROMANA.
- 3.—ORION.
- 4.—LUMINA.
- 5.—NORRIS.
- 6.—PREDINGER.
- 7.—STANDARD.
- 8.—MITRANY.
- 9.—ROUMANIAN CONSOLIDATED OILFIELDS.
- 10.—ANGLO-CONTINENTAL.
- 11.—VEGA.
- 12.—ROMANO-AMERICANA.
- 13.—FRATIA.

1. **AQUILA FRANCO ROMANA.**—This French-owned refinery was constructed in the year 1907–08, and was capable of an output of 600 tons per day. It was of modern construction and endowed with all the auxiliary plant, such as rectifiers, agitators and refiners, equal to its working capacity.

The destruction was carried out on the lines of work done at Tergoviste, and the actual firing successfully executed. The quantity of oils destroyed was 12,000 tons.

2. **ASTRA ROMANA.**—Originally a small refinery in the suburbs of Ploesti, since taken over by its present Dutch owners. In 1905 the plant was practically rebuilt, and it was enlarged from a working capacity of 100 to that of 1,000 tons per day. The owning company is an "offshoot" of the Royal Dutch and Shell Trading and Transport Company.

The refinery was situated immediately behind the Ploesti station, and alongside the Orion, Lumina and Norris refineries. It was, therefore, necessary when firing, to deal with these three refineries as an entity, and large channels were cut through the intervening land, allowing the oil from the huge storage tanks to circulate to all the buildings and plant therein. Quantity of oil destroyed 90,000 tons.

When fired, the conflagration assumed such great proportions that unfortunately a number of men were caught and burnt alive.

3. ORION.—This refinery, which was burnt with the Astra, is Dutch owned and of recent construction. Capable of working 600 tons of crude oil per day.

In addition to the ordinary refining plant it possessed valuable lubricating oil works and large storage tanks. Quantity of oil destroyed, 50,000 tons.

4. LUMINA.—A small refinery, also included in the large Astra destruction, with a working capacity of 80 tons per day. Special precautions had to be taken to keep the fire and running oil within bounds, owing to its close proximity to the railway station sidings, where a large number of troops and materials were being hurried away to Buzeu. The direction of the wind materially assisted us in this work. Quantity of oil destroyed, 4,000 tons.

5. NORRIS.—A small refinery having a working capacity of 90 tons per day.

It recently changed hands, the Bucharest "Baneasa" Refinery Company having bought it from its previous German owners shortly before Roumania entered the war. *This should be noted as the transfer may not have been bona fide.* Quantity of oil destroyed, 3,000 tons.

6. FREDINGER.—This refinery, originally belonging to a native, changed hands several times up to the year 1911, when it came under French control. It was enlarged from time to time, and latterly was capable of an output of 120 tons per day.

The refinery being adjacent to the outskirting houses of Ploesti, special preparatory work was also necessary here before we commenced the destruction. Quantity of oil destroyed, 10,000 tons.

7. STANDARD.—This refinery, ostensibly bought some four years ago by a British company, has been dealing extensively with the enemy.

I understand the managing director, who is an Austrian, is now interned in this country, *but the whole affairs of the company should be carefully investigated before any claims for compensation are considered*, and the position of the English company should be enquired into.

The refinery is equipped for working 300 tons of crude oil per day, and has large storage tanks. An important lubricating oil plant was installed but not completed.

On account of the immediate vicinity of this refinery and its storage tanks to the main railway and sidings, the oil could not be fired in the refinery and had to be run out into the fields, into large dams, before firing. Quantity of oil destroyed, 15,000 tons.

8. MITRANY.—This refinery, situated on the eastern boundary of the town, was recently increased to a daily working capacity of 50 tons per day. Generally, the plant was old and worked by the owner for all it was worth, without renewing any parts. The oil stocks were fired in the vicinity of the refinery and the place wrecked. Quantity of oil destroyed, 2,500 tons.

9. ROUMANIAN CONSOLIDATED OILFIELDS, LIMITED.—This was an old refinery recently improved, having a working capacity of 25 tons per day.

The four stills were almost burnt through and needed repairs. The oil stocks were burnt around the installation, together with the stocks of the Anglo-Continental Company's oil, amounting to 5,000 tons.

10. ANGLO-CONTINENTAL.—This was a new refinery, built 1913/14, and had a working capacity of 100 tons per day and storage for 6,000 tons.

Dams were built round this, and the Consolidated refineries, the installation and reservoirs were all inside this enclosure when the dams were fired, thus being completely wrecked.

11. VEGA.—This German-owned modern refinery, situated on the northern boundary of Ploesti, had a working capacity of 1,000 tons per day, and was well designed and equipped for making the best lubricating and other special kinds of oil. The refinery and tanks covered about 40 acres, and special measures had to be taken to ensure complete destruction.

It was soon found that the manager, a Mr. A. Nazarie, was pro-German and put many obstacles in the way with a view to blocking our chances of complete success. It is here that the enemy may possibly repair the damage done more quickly than elsewhere. Communication trenches for the oils to circulate freely had been previously arranged, but by some ingenious device the manager endeavoured to rob us of the results we had hoped for. Counter measures were at once taken, and this had to be done quickly, for the enemy was then on the outskirts of the town and the Roumanian troops evacuated.

The hurried nature of the work here, and the close proximity at which the work of destruction had to be carried out, caused several uncomfortable experiences to the party. One 50,000 ton reservoir was virtually lifted in the air and simultaneously the half-ton plates were scattered far beyond and around the officers working.

Here Captain Masterson and others narrowly escaped being crushed and burnt. In the work of destroying the remaining stills and rectifying plant above ground and in subterranean buildings another officer of the British Mission was literally blown out of the main exit into the open with his clothes partially alight. Quantity of oil destroyed 75,000 tons.

12. ROMANO AMERICANA.—This was the largest refining plant and storage station in or around Ploesti. In the construction of these works great care had been taken to provide against fires spreading from one reservoir to another, or to the distilling machinery, which made our work more laborious.

For complete destruction it required the laying of pipe-lines to the various installations to flood them with lighter oils. Some dams, closing in the east end of the refinery, were filled with residues and fired. One hundred reservoirs were fired individually, and, finally, the installations were fired and each vessel and boiler exploded. The spectacular sight was remarkable and the heavy volumes of smoke, which stretched for some 100 kilometres or more, must have considerably inconvenienced the enemy who was then on the outskirts of the town on the windward side. The quantity of oil destroyed was 120,000 tons.

13. FRATIA.—This refinery is situated in the town itself, and it was deemed advisable not to fire it but to run off the products, and destroy the essential parts of the machinery. We were asked to leave some residues for the use of the town electric light station. This, unfortunately, I had to agree to, but only little was left, 6,000 tons being run to waste.

VI. BAICOL.—An oilfield of considerable importance situated on the Ploesti-Predeal Railway. Oil has been produced from this field for over 20 years and new sources were discovered in 1914 bringing about new activities.

The oil sand, from which the present production is obtained, is met with at a depth of 4-500 metres in the Dacian series.

There were 36 producing and 32 drilling wells at the date of destruction, belonging to 26 companies.

The average daily production was 180 tons, but it is characteristic of the field that gushers are struck from time to time yielding between 600 and 1,200 tons per day.

The drilling of a new well requires on an average a period of about 5 months, providing complete equipment and installation is available. It should be generally added that the "drilling in" of a well does not mean that the well is ready to produce. From the time that a well is drilled in to the time it is prepared and connected up for production a period of 2 or 3 weeks usually elapses, according to the productivity of the area. The wells were plugged and fired in conjunction with the Roumanian authorities. The quantity of oil destroyed here was 6,000 tons.

AURORA.—This refinery at Baicoi was originally owned by a Dutch company, but since the year 1907 has been controlled by the German Steaua Romana who from time to time worked the refinery.

Its working capacity has 600 tons per day, but all the machinery were old and in bad condition for want of repairs. The machinery was wrecked and 21,500 tons of oil destroyed.

ASTRA DEPOSIT.—Situated near the railway line and close to the Baicoi station, contained 22,000 tons of oil. This was run off as, owing to its close proximity to the railway line, on which the Second Army (General Averesco) had then to rely for its

retreat and also to the main telegraph system running virtually between the tanks, firing was out of the question, particularly at I was under promise in this respect to General Averesco. The whole of this benzine was lost to the enemy, by its percolation into the gravel beds. It is not certain whether it was afterwards fired. The enemy cavalry cut in here 24 hours later, and the army was forced to retreat through the hills, abandoning their guns, as this, their only railway line of retreat had been cut off.

STATE RESERVOIRS.—These were also in the immediate neighbourhood of the station and railway at Baicoi, and for the same reasons as described above, the 9,000 tons of oil contained in the three tanks were run off and allowed to percolate into the gravel.

The rest of the tanks belonging to this important pipe line deposit were empty as I proved by personal inspection, accompanied by Lieutenant Phillipon.

VII.—**CAMPINA**.—Situated immediately north of Baicoi, is also on the Ploesti—Predeal railway line. The oil field has been in production for the last thirty years and is on the point of becoming exhausted.

Oil is found in the Meotic series between 300 and 500 meters. The exploitation belongs almost entirely to the German owned *Steaua Romana*, who here also had their refinery, the largest in Roumania.

The field possessed 21 drilling and 22 producing wells, and yielded a combined production of 270 tons per day.

Prior to the date of destruction some 20,000 to 30,000 tons of benzine had been run down five or six of the wells. Effectual plugging was carried out on these and the other wells. The average time required to drill in a new well with the percussion system is about eight months under normal conditions.

The refinery, which had a working capacity of 1,800 tons per day, was completely destroyed by Captain Scale and Lieutenant Simpson, the former having just arrived from Petrograd and been detailed by me for this work.

The stocks of oil amounting to about 60,000 tons were fired on the night of the 5th December, but before carrying this out, it was necessary to await the general's report that his rearguard had passed through, as the firing would have interfered with his movement.

The refinery being situated in the centre of the town, difficulties were encountered with the civil population who were also very pro-German. Eventually the houses were evacuated and the work of destroying commenced, but not before I had seen General Averesco for the third time in connection with this particular work. During the operation Lieutenant Simpson was blown up against a building and slightly wounded by one of the explosions which ensued. The last work of destruction was carried out when the enemy was actually entering the town.

DOFTANA.—This large deposit, owned by the *Steaua Romana* Company, was gutted and the reservoirs demolished.

VIII.—**BUSTENARI**.—This oilfield is spread over a large expanse of territory situated between the Telega and Doftanet villages and contains the sections known as Telega—Calinet—Grusar—Mislisoara—Gropi—Chiciura—Bustenari—Stejar and Bordeni.

It is an old field and oil has been extracted for 30 years and is now on the point of exhaustion. Here the wells do not fluctuate in their production and there are many which have been steadily producing two or three tons daily for the past three to four years with no appreciable diminution.

There are 402 producing and 190 drilling and other wells owned by 80 companies or private owners.

The work of plugging was commenced on the 4th December and on the 6th December the wells were fired with the exception of those in the village and near the important roads. These were cut down with axes.

Whilst the last of this work was being carried out the enemy machine guns had reached the summit of the hill close to and overlooking the area in question, and Lieutenant Hayward had to make his way across country through the hilly region to the east.

The stocks of oil, consisting of 22,530 tons, were fired.

IX. **ARBANASI POLICIORI**.—This oilfield lies in the Buzeu Valley and has been developed of recent years. There were 93 producing and 40 drilling wells owned by 6 companies the most important of which was the German owned *Steaua Romana*.

Events were moving so rapidly that on 8th December it became evident that unless immediate action was taken the field would fall into enemy hands. I decided to plug and fire it on the same day. The enemy was in close proximity, already having passed through Policiori.

The field is comparatively a new one, opened in 1908, the oil-bearing strata is found in the meotic sands at 450 to 550 metres. The time needed for drilling is 7 months, but this average was only lately reached, 9 months would be a fair average under normal conditions.

After plugging and firing the wells, the timber stocks, workshops, power, electric light and water stations were completely destroyed.

X. BERCA.—The wells here belonged to an Englishman and were well plugged and destroyed.

The oil is encountered in the meiotic series at depths varying from between 300 to 700 metres, but the yield is not prolific.

There were 10 producing and 9 drilling and other wells. 200 tons of oil were destroyed.

XI. BUZEU.—Both the Roumanian and Russian Corps Headquarters were stationed here at the time of my visit and after making the necessary arrangements with General Polovtsoff, I detailed Lieutenant Simpson on whom I could thoroughly rely from past experience, to carry out the work of destruction at the last moment, no matter what orders to the contrary he might receive.

This released me and the rest of my mission to turn our attention to corn and the important works in the Braila district. I saw Buzeu burning 20 kilometres away on the 13th December and received Lieutenant Simpson's report thereon that my instructions had been completely carried out.

The town contained the following refineries and deposits :—

BUZEU—NAFTA.—A Belgian Company operating in Arbanasi. There were three reservoirs containing 4,500 tons of crude oil, but owing to their close proximity to the road, along which troops were passing, the oil was not fired round the reservoirs, but in previously constructed dams some 300–400 metres distant. The reservoirs in this instance remained intact.

SATURN.—This was a fairly important refinery with a working capacity of 200 tons per day, and equipped for manufacturing lubricating oils.

The stocks of oil and products, some 10,800 tons, were all fired in dams which had been previously built around the reservoirs, completely destroying them.

Small channels were cut leading into the refinery and along which oil flowed. The place was then fired and completely demolished.

GOLDENSTEIN.—A small Roumanian refinery with a working capacity of 15 tons per day. As it was situated on the main road, which was blocked with traffic, it was decided not to fire it.

The stocks of oil, 1,300 tons, were all run off, but the machinery was wrecked as well as the refinery.

GOVERNMENT DEPOSIT.—This belonged to the government pipe line system and was rented out to the various companies for the purpose of accommodating them with storage. At the time of destruction there were 12,000 tons of oil stored in these reservoirs which were fired and wrecked with the exception of five reservoirs, which, not having had any oil in them could not be destroyed.

STEAUA ROMANA.—The deposits of this German owned company amounted to 17,430 tons of oil from their Arbanasi field. The large 7,500 ton reservoir together with two smaller ones could not be destroyed owing to their close proximity to the road and railway station. The oil was led off through an 8-inch line to dams a kilometer distant and was fired.

Other stocks of oil destroyed were at—

GAGENI (Prahova)—1,900 tons belonging to the Orion Company.

PLOESTI (Prahova)—30,000 tons belonging to the Astra Company and deposited in their pipe line station.

PLOESTI (Prahova)—3,000 tons in the Roumanian Consolidated pipe line station.

(1) **TELEAJEN** (Prahova).—50,000 tons. This quantity was deposited in the State pipe line tanks.

PLOPNI (Prahova).—20,500 tons, belonging to the Romana Belgiana Refinery, were burnt.

Other oilfields destroyed were—

APOSTOLACHE.—With 1 drilling and 4 producing wells.

PACURETI.—With 1 drilling and 1 producing well.

CEPTURA.—With 2 drilling and 1 producing well.

These last three localities had a total daily production of 13 tons, and there was not much activity to be seen.

XII. GURA OCNITZA.—This was a fairly important field, producing about 180 tons daily from the Dacian beds. Important exploratory deep drilling was being carried out and had already attained a measure of success. These deep wells (2) were thoroughly plugged. The other 18 drilling wells and 16 producing wells, belonging to the International Oil Company, were similarly dealt with and all stocks of oil fired.

XIII. TINTEA.—This field is a continuation of the Moreni-Baicoi line, and at the time of destruction was producing 170 tons per day. 22 drilling wells and 41 producing wells were destroyed together with 8,500 tons of oil.

XIV. MONTEORU (Buzeu).—This old field now yielding only a small production was also fired together with 3 drilling wells 16 producing wells and 1,680 tons of oil.

COMPENSATION.

I have already mentioned that the conditions which I found facing my mission, made it, in the time at our disposal, *impossible to collect details* as to the general stores, plant spares, the proportion of crude to refined oil, stocks of timber and many other items. Efforts were made, but the records were accidentally destroyed by fire during the work of destruction. My French colleague, Lieutenant Phillipon, also lost his records.

The fact, therefore, must be faced that we shall be lacking complete details of damage done when the question of compensation has to be considered in all its phases. There will, however, be several ways of checking any claims which may ultimately be submitted.

In the case of companies I fear little difficulty. The law of the land provides that inventories and journals should be stamped at the Tribunal of the district each year, and we have the right to demand these.

The past balance sheets and records of production, year by year, will tell their own tale, and so will store books of stocks and their issues. Beyond the Rouman-Americana Company, where stocks of plant and machinery were heavy and said to be worth some million and a quarter American dollars (this Company lodged their books in the American Legation), I found, with a few exceptions, the stocks of spares, tools, timber, pipes, and other items to be comparatively small. Much of this heavy plant could, of course, not be damaged.

The value of any plant claimed for should be subjected to special technical examination, and a satisfactory check should be possible, *but the ground must be visited before any figures can be agreed upon.*

Again, the enemy while in occupation will doubtless endeavour to reconstruct some sections of the industry, and this should form an item for credit of any claims submitted.

The question of royalties will require careful consideration. *There are many owners of such royalties who occupy high positions in the political world and who may influence the compiling of claims to be submitted.*

Having gained some insight into local politics, I suggest that it will be advisable that whatever compensation is agreed upon, provision should be made that all payments to owners should bear the endorsement of an independent authority, which is Sir George Barclay's suggestion, and thus ensure that whatever monies are provided go to the owners and any balance over is returned. I hear on reliable authority that local owners fear that, although the Allied Governments may compensate to everyone's

satisfaction, their proper share will not reach their hands. Great care has been taken to avoid any discussion on this head by any members of my party.

I understand from Sir George Barclay that he has taken the necessary steps to protect the interests of the British Government by notifying the Roumanian Government that all claims must be submitted for approval.

The quantity of oil of all kinds cabled you as destroyed can be taken as fairly correct i.e., 210,000,000 gallons. This may be subject to modification by the amount of oil used in the country immediately prior to destruction, but any such modification would not materially effect this total. You can be sure that, with this proviso, this amount was destroyed.

Whether compensation is based on cost or selling prices is a matter which will no doubt require consideration.

I have made efforts to arrive at an estimate to allow me to indicate the total value involved, but so far I have not arrived at any reliable figures.

It is quite possible that small sections, here and there, of the industry may be restored in the near future—under the conditions in which the work was carried out—this could not be otherwise; but any such restoration should influence the final claims for compensation.

There are other points of importance connected with the financial side. I have only selected these few to indicate the possibilities in this direction.

This report covers, with the single exception of the Bacau oilfields, the whole of the Roumanian Oil Industry. The damage is great and I hope will be found effective as time progresses.

When it became obvious to many of those interested in oil that we intended our measures to be definite and complete, it was constantly found that before the next field could be reached everything in the vicinity of the wells useful for plugging had been carted away. In many cases the labour evacuated, and consequently great difficulty was experienced in obtaining the necessary materials with which to effectively "plug"—often hours only were left to the party to complete the work, and on more than one occasion members of the Mission were virtually cut off.

Time alone can balance the gain as against the loss and devastation with which it has been the Mission's painful duty to lay waste the land; for the trail of the destroyer has indeed been laid low over it, and I venture to think that where we have passed a deep impression of what war should be has been made.

It certainly has been a revelation from the highest to the lowest that our conception of obstructing the enemy means sacrificing the individual and the fruits of the earth, at no matter what cost to either, to accomplish our ends.

RECOMMENDATIONS.

I have to mention the following members of the Mission for their untiring energy and devotion to duty:—

A. *Foreign*.—Captain Prince G. B. Bibesco (attached to me for special duty), for conspicuous gallantry at Moreni, who at great personal risk cut off an encircling flow of lighted benzine, and also behaved in an exemplary manner on other occasions when assisting in igniting and destroying vast stores of refined and other oils, commencing with the Mission until the work of destroying the oil industry was completed.

Lieutenant Maurice Phillipon, engineer and chemist to the Mission Militaire Technique Française des Munitions, for devotion to duty, untiring energy and self-sacrifice at Tergoviste, Morene, and particularly at Ploesti, where he narrowly escaped while lighting large quantities of benzine.

Lieutenant I. Tanasescu, Roumanian Government Ingineur des Mines, for his untiring energy and devotion to duty, and for materially assisting the Mission in their work at Tergoviste, Moreni, and elsewhere.

2nd-Lieutenant A. Tzantzareanu, Roumanian Government Engineer, for his great and invaluable help to the Mission, often under circumstances of extreme difficulty and against the views held by many of his colleagues. This officer ran many risks, and showed great zeal and energy in the carrying out the instructions to destroy various distilleries.

(The only two mining officers who were generally found at their posts at critical moments.)

B. *British*.—Captain Thomas Samuel Masterson, for conspicuous bravery at Moreni, Ploesti, and Arbanasi; at great risk of life re-entering the main distillery buildings at the Vega works; revisiting the destroyed works at Tergoviste, Gura Ochitza, and Ochiuri to see that the works were completely destroyed; passing through the rear-guard of the retreating army and firing remaining untouched works of value and generally for exemplary conduct throughout the Mission's work of destruction, both in oil and corn.

Captain J. Scale (of the Russian Mission, Petrograd) for conspicuous gallantry and determination at Campina where, to convince the Roumanian General Voiteanu that further delay in the work of destruction was dangerous, rode out beyond the Roumanian rearguard until nearly surrounded by the enemy. Then later, although the Roumanian Army had left, he stuck to his post until the work of destruction of the important refinery works, stocks of highly gaseous oils and stores, although opposed by Mayor and Councillors, was completed, narrowly escaping capture.

Lieutenant Philip Huntington Simpson who in the face of great opposition carried out difficult and dangerous work at Campina. Although slightly wounded by an explosion and his clothes badly burnt he succeeded in carrying out the work of destruction entrusted to him. To escape capture he had to make his way across country.

Lieutenant John Thomson Hayward for gallant conduct at Moreni, later at Campina, and subsequently at Bustenari. This young officer single-handed fired and destroyed the important works and wells at Bustenari, although well knowing the enemy were already in his rear, ultimately walking some 60 kilometres through hilly native paths to regain safety and suffering much privation, until reaching Buzeu.

From the commencement Lieutenant Hayward has distinguished himself for his zeal, energy and courage, and is deserving of high praise.

It has been a great privilege to command such officers and I crave your special notice of their gallant conduct.

The work of the mission in oil alone was carried out day and night without interruption for the first ten days.

I have the honour to be,

Sir,

Your obedient servant,

J. NORTON GRIFFITHS,

Lieut.-Colonel.

JASSY,

22nd January, 1917.