Report No. 45.

ANNUAL REPORT

OF THE

RESEARCH COUNCIL OF ALBERTA

1944

EDMONTON
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The following report, the Twenty-fifth Annual Report of the Research Council of Alberta, was submitted in March, 1945, by the Director of Research Dr. R. Newton, President of the University of Alberta, to the Chairman of the Council the Hon. N. E. Tanner, Minister of Lands and Mines. The Chairman submitted the report to the Premier of Alberta, the Hon. E. C. Manning, who tabled it in the Legislature.

The first sixteen of the Annual Reports of Council were tabled in the Legislature, and subsequently published. The reports for the years 1936-1942 inclusive were tabled in the legislature but not published. The present policy of the Council is to submit only brief Annual Reports to the Legislature; but to publish, from time to time as available, detailed reports on specific subjects.

This annual report, the second in the new series of brief reports, gives a general account of the work of the Council during the calendar year 1944.

The offices and laboratories of the Council are situated in the buildings of the University of Alberta. Requests for information and reports should be addressed to the Secretary, Research Council of Alberta, University of Alberta, Edmonton, Canada.

MEMBERS OF COUNCIL

The Honourable N. E. Tanner, Minister of Lands and Mines, Chairman.

The Honourable E. C. Manning, Premier of Alberta.

The Honourable W. A. Fallow, Minister of Public Works.

Dr. R. Newton, President of the University of Alberta, Director of Research.

L. E. Drummond, Esq., Edmonton.

J. E. Davies, Esq., Medicine Hat.

The Council operates under the Research Council Act of 1930, as amended 1943.

The offices and laboratories of the Council are at the University of Alberta. The Secretary is Professor E. Stansfield.

TECHNICAL ADVISORY COMMITTEE

Dr. R. Newton, President of the University of Alberta, Director of Research, Chairman.

Mr. R. S. L. Wilson, Dean of Applied Science, University of Alberta, Assistant Director of Research, Deputy Chairman.

Mr. W. D. King, Deputy Minister, Department of Trade and Industry.

Mr. G. H. Monkman, Deputy Minister, Department of Public Works.

Mr. J. Crawford, Chief Inspector of Mines, Department of Lands and Mines.

Dr. J. A. Allan, Department of Geology, The University.

Dr. E. H. Boomer, Department of Chemistry, The University.

Dr. K. A. Clark, Department of Mining and Metallurgy, The University.

Prof. N. C. Pitcher, Department of Mining and Metallurgy, The University.

Prof. E. Stansfield, Fuels, Chief Research Engineer and Secretary of Council, Secretary.

TECHNICAL STAFF OF RESEARCH COUNCIL OF ALBERTA

The following have held full time, permanent appointments during the year:

Edgar Stansfield, Chief Research Engineer.

William A. Lang, Chemist, Fuels.

David S. Pasternack, Chemist, Bituminous Sands.

Jack S. Charlesworth, Chemist, Gasoline.

Edward Tipman, Assistant Chemist, Gasoline.

Anna Malanchuk, Compiler.

Colin A. Genge, Assistant Chemist, Fuels.

Catherine A. Fergie, Assistant Chemist, Fuels.

Isobel H. Williamson, Assistant Chemist, Gasoline—to August.

Valetta M. Alexander, Assistant Chemist, Gasoline—from September.

The following held temporary appointments during the year:

John L. Carr, Field Geologist, from May.

Rudolph R. Grunert, Assistant Chemist, Bituminous Sands, May to September.

Edith C. McCannel, Assistant Chemist, Gasoline, May to August.

Hugh J. McDonald, Assistant Field Geologist, May to October.

R. Lorne McDougall, Assistant Engineer, May to September.

William S. Peterson, Assistant Chemist, Natural Gas, to September.

The following University scholarship holders worked for the Council without pay:

J. Harry A. Donald from October.

Donald Quon from October.

The following members of the Faculty of the University of Alberta assisted in the work of the Council:

Dr. John A. Allan, Geology.

Dr. Edward H. Boomer, Natural Gas and Bituminous Sands.

Dr. Karl A. Clark, Bituminous Sands.

Assistant Professor Ewald O. Lilge, Glass Sands.

Assistant Professor Andrew Stewart, Agricultural Economics.

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This report, for the calendar year 1944, covers a full year's work. Laboratory and field work were somewhat curtailed by the time given to the preparation and publication of reports; but were more seriously curtailed by the continued war-time difficulty and delays in obtaining technical staff, apparatus and supplies. No progress at all could be made in the study of a biological cycle as provided for in the estimates for the financial year of 1944-45.

Reports follow on seven different sections of work completed or in progress.

BITUMINOUS SANDS

Much of the efforts, during the year, of those of the Research Council of Alberta staff concerned with bituminous sands has been in preparation for participating in the building of a separation plant in the North. That such a plant would be undertaken, under provincial government auspices, was fairly apparent from the start of the year. Little doubt was left when the Legislature passed a resolution authorizing the government to spend $250,000 on a separation plant. The matter was settled when the government entered into an agreement with Oil Sands Ltd. for the building of a plant on the lease of this company. Dr. K. A. Clark made two journeys to the Oil Sands Ltd. plant during the summer season. During the first, a contour map of the plant, quarry, camp site and adjacent land was made in anticipation of the probable need for such a map for future planning. Also, supplies of bituminous sand from the quarry were collected and shipped to Edmonton for experimental work in the Research Council laboratories. During the second journey, a comprehensive suite of samples was collected in the Oil Sands Ltd. separation plant for examination to give information about the operation of the plant. More bituminous sand was shipped to Edmonton. At Edmonton, throughout the year, tests were run on the Oil Sands Ltd. bituminous sand in the laboratory-scale separation plant. These tests gave direct evidence of the amenability of this sand to the separation procedure used by the Research Council. As a result of the year's efforts, the Research Council has made preparations to play its part in the design and operation of the plant to be built on the Athabaska River at Bitumount.

Work was continued throughout the year on the general study of the separating of oil from bituminous sand by washing with hot water. While there is no doubt about the separation taking place, there still are things to be learned about how the separation procedure works. A good theoretical explanation for the separation process is much to be desired. Bituminous sand is not all the same by any means. Its behaviour in a separation plant displays decided variability. Knowledge of the reasons for the variability will be

of very practical value when separation plants are operated commercially.

The method of separating the oil from bituminous sand by washing with hot water, as practiced by the Research Council, is briefly stated as follows. Bituminous sand is mixed and heated with water. The quantity of water used to form the bituminous sand pulp is kept small so that it all will be absorbed into the pulp. The hot pulp is fed into a stream of hot water which sweeps it into a fairly quiet body of hot water as a dispersion of sand and oil bubbles. Things are so arranged that air bubbles are entrained in the stream of water where the bituminous sand enters it. Air-oil bubbles are formed and collect as a buoyant froth layer on the surface of the body of hot water while the sand sinks. The hot water for the stream is pumped out of the body of hot water and runs back into it; in other words, it is a circulating stream.

The main factors which influence the separation process have been identified. The hot water when mixed with the bituminous sand pushes the oil off the sand surfaces. If only a small amount of water is present in the pulp, the oil displaced from the sand lies among the sand grains as small flecks of sand-free oil. If a large amount of water is present, however, the small oil flecks gather together in clots and enmesh sand grains. On feeding the pulp into the stream of hot water, sand and oil are dispersed and the oil forms oil bubbles with the air present in the stream. The oil bubbles float whereas the oil, alone, would sink being heavier than water.

The air-oil bubbles tend to become attached to sand grains and to float them. This results in making the oil froth sandy and, of course, this is an undesirable condition. It is impossible to prevent some sand being floated. But by keeping the air available for floating the oil under control it is possible to hold the flotation of sand to a minimum. The effect of aeration and ways of controlling it have been given special study by the Research Council.

The main advance during the year in the study of factors affecting separation has been recognition of the fact that time is important in the displacing of oil from the sand grains by the hot water. Bituminous sands differ in regard to the time required. At one extreme, the displacement of the oil by water has taken place in Nature; as mined, each sand grain is separated by a film of water from the oil envelope which surrounds it. No time is required, in the separation plant, to displace the oil from the sand surface since this has already happened. At the other extreme, the oil is in direct contact with the sand grains in the mined material and a considerable period of time is required before water can succeed in displacing it. Mechanical mixing, high temperatures and alkaline conditions shorten the time for displacement. Fortunately, evidence so far indicates that the common condition that will be met in practice will require but a short time for oil displacement.

COMPILATION OF NATURAL RESOURCES AND RESEARCH DATA

The main work of the year was in connection with the preparation, publication and distribution of a report on Alberta coals. Other work done included the preparation of an abstract of all available publications on bituminous sands, a tabulation of the

principal low temperature carbonizers and carbonization projects, and a compilation of data on certain mineral resources.

FUELS

The publication in October of a report on the coals of Alberta marked the completion of an important project. The report makes available the results of many years' study of the coals of the Province by the Research Council of Alberta; but, where available, information from the fuel testing laboratories of the Bureau of Mines, at Ottawa, was also included.

The sampling and analysis of the coals of Alberta, in co-operation with the Provincial Mines Branch, was continued through the year. Analyses were also made for the Emergency Coal Production Board.

The installation of equipment for testing coals in automatic domestic stokers was completed early in the year, and tests were made throughout the rest of the year, except during the warm months. Sixteen coals were tested in the underfeed stoker and seventeen in the overfeed stoker—twenty-two coals in all being tested. One sample was from Kentucky and the others from sixteen diffrent coal areas in Alberta.

It was found that a satisfactory coal should be low in ash to avoid too frequent cleaning of the fire. A dust-free (oiled) coal is preferable, of a uniform size suited to the individual stoker.

Coal for an underfeed stoker should be non-coking, unless an agitator is part of the equipment; otherwise any rank of Alberta coal can be burned. The ash should form a clinker strong enough to permit its removal, by tongs, from the fire, but should not form so dense a clinker that normal combustion in the fire bed is interrupted. Many of the coals tested failed with respect to suitable clinker formation; but some non-clinkering coals can be adapted for use either by blending them with a clinkering coal or by chemical treatment.

Coal for an overfed stoker should be free-burning, and only such coals were tested. Most of these proved satisfactory, but a few formed such a dense clinker that normal combustion was interrupted.

Chemical analyses of a number of coal ashes were made for the above work; and an apparatus was devised and constructed for evaluating the smokiness of a coal.

Another major project undertaken was the low temperature carbonization of low rank coals. A carbonizer was designed, constructed and successfully operated to make a char. That is a clean, smokeless fuel of higher heat value than the original coal—in some cases the heat value was increased as much as 55%.

The recovery of by-products from a carbonizer involves a many-fold increase in both construction and operation cost; and the economic value of any by-product from the low rank coals to be treated is more than doubtful at present. The carbonizer was therefore designed for low cost construction and operation, by taking full advantage of the non-coking quality of the coals and the recognition of the inadvisability of collecting by-products.

The char made was primarily intended for test by the National Research Council in portable gas producers attached to motor

vehicles, when that Council was conducting an investigation of the use of alternative fuels to replace gasoline, etc. Delay in construction of the carbonizer prevented this test of the char; but it is hoped to make the desired tests later. The char, as made, is not a good fuel for general use on account of its small size and light weight; but studies are planned looking to the development of wide markets.

No time was available for work on binderless briquetting during the year. An extensive investigation, however, was carried out for one colliery, and a report was submitted showing the minimum binder required with different samples of coal, and other data. It is hoped that this may lead to the establishment of another briquetting plant in the Province. An investigation was also commenced on the briquetting of char, with the production of a smokeless, weatherproof briquette as the goal.

The gasoline testing laboratory was kept busy during the year, although the number of samples tested, 616, was rather lower than that of the previous year. As before, the work done was mainly for the Royal Canadian Air Force. At the request of Air Force Headquarters, J. S. Charlesworth attended conferences in the Spring at Ottawa and Toronto relative to testing work for the Air Force.

Towards the end of the year a winter survey was commenced of the motor gasolines on sale at the filling stations of the Province. Twenty-seven samples were obtained, representative of many brands, through the Provincial Department of Trade and Industry. This survey will be concluded early in 1945.

An investigation was also made of improved methods for introducing purple dye into gasoline, and of detection of this dye in the presence of other colouring matter. A study was also made of gasoline markers used elsewhere. The above work was carried out in consultation with the Department of the Provincial Secretary and with the Provincial Analyst.

An electronic knock meter, for use on the octane engine, was devised, constructed and tested by H. Stevenson, a senior student in electrical engineering, with the co-operation of the laboratory staff.

As in 1943, the fees received covered the operating cost of this laboratory.

GEOLOGY

The geological work under the Council is carried out under the direction of J. A. Allan in conjunction with the Department of Geology at the University of Alberta.

Two major projects and a few minor ones were undertaken during the year. These are mentioned in brief reports as follows:

1.—*Wapiti-Grande Prairie Coal Survey.*

The main project carried out this year was a geological field investigation in the Grande Prairie district, south of Wapiti river, to study the coal occurrences and to determine a possible coal supply for that part of Alberta, somewhat removed from the developed coal fields. A pack train field party, with John L. Carr in charge, spent twelve weeks investigating the geology, measuring sections of the strata and determining the character and extent of the coal measures. Between September 17th and October 15th a traverse by boat was made along the Wapiti river from Sylvestre creek to

township 68, range 11, west of 6th meridian, to the mouth of Big Mountain creek, examining the geological section exposed along the sides of the valley.

There is considerable coal widely distributed in this area. The coal seams are in the Wapiti formation and the coal is correlated with the Belly River. There are two areas in which the coal appears to be of special importance and could be developed. These occurrences are on Pinto creek in township 68, range 10, about 40 miles southwest from Wembly, and on the Cutbank river, chiefly in township 64, ranges 6 and 7, forty to fifty miles almost due south from Grande Prairie.

On Pinto creek a flat lying coal seam outcrops with a total thickness of 4 feet 8 inches with a clay parting of 4 to 6 inches. This deposit is now being developed by the A.B.C. Development Company.

On Cutbank river coal outcrops along the bottom of the valley for a distance of about five miles in township 64, ranges 6 and 7. These outcrops appear to be on one coal seam which consists of as much as 8 feet 10 inches of coal within 10 feet 2 inches of section. To reach this deposit a road about 60 miles long would have to be constructed.

Towards the head of Cutbank river in township 63, range 10, there is a total thickness of 9 feet 5 inches of coal exposed within 11 feet 9 inches of strata. This occurrence is less accessible than those on the Cutbank in ranges 6 and 7.

On Nose Mountain in township 63, range 11, there is a total thickness of 11 feet of coal exposed in 15 feet 9 inches of section, but this occurrence is also difficult of access at present and the coal is quite dirty.

On Big Mountain creek at the mouth of Bridge creek, in the southern part of township 69, range 5, two thin seams of coal outcrop. The upper seam, 2 feet 1 inch in thickness, contains 4 inches of bone and the lower seams consists of 4 feet 2 inches of dirty coal and carbonaceous shale. The two seams are separated by 1 foot 7 inches of clay.

These five occurrences of coal south of Wapiti river in this area, contain sufficient coal to warrant prospecting. This geological investigation indicates that south of the Wapiti there is an ample supply of coal for the needs of the district.

Coal has been mined at several points along the north side of Wapiti valley and along Willow creek. The seams mined were thin and all the mines are abandoned except that operated by the Baldwin Collieries in section 35, township 70, range 7, nine miles southwest of Grande Prairie, where the seam is less than 3 feet in thickness, and the coal by analysis is of high volatile C bituminous rank.

It is suggested that test drilling between Wapiti river and Grande Prairie might prove the occurrence of a coal seam thick enough to be mined.

A report on this area is now being prepared and will be published at an early date.

2.—*Structure Section Across Rocky Mountains.*

During the past four seasons J. A. Allan has been spending some time each season working out the structure and studying the

various rock formations across the Rocky Mountains in the vicinity of the North Saskatchewan valley between Nordegg and Horse Pass. This field research has been made possible through a grant received from the Penrose Fund, administered by the Geological Society of America, New York. During the early part of September, J. A. Allan completed the field investigation on a portion of this structure section.

The knowledge that will be obtained on the thickness and character of the rock formations within the Rocky Mountains, will be valuable in interpreting the rock formations that occur under the foothills and plains, when drilling explorations for petroleum are being carried out. The key to the interpretation of the succession of rock formations encountered by drilling east of the mountains, is to be found within the ranges of the Rocky Mountains where the corresponding formations outcrop.

3.—*New Salt Deposit.*

An important discovery of a bed of rock salt was made in October about 11 miles southeast of Vermilion and 10 miles south of the Canadian National Railways, when the Vermilion Consolidated Oils in No. 15 well, drilled through 420 feet of rock salt in the search for petroleum. An examination of these cores was made at Vermilion on November 7th and 8th.

The salt occurs between 3490.9 feet and 3901 feet below the surface of the well which has an elevation of 1978 feet above sea level. This thick salt bed is mainly impure, with colors varying from light to dark brown, some very dark and some reddish beds, with patches of reddish mineral matter which may be red fibrous gypsum. There are some layers of grey salt, transparent to translucent, and quite coarsely crystalline. Some layers contain much shale and are dark brown to greenish in color. There are a few thin layers of greenish shale interbedded in the salt.

This salt bed, though much more impure, is considered to be of the same age as the white salt bed, now being developed at Waterways. The age of the salt bed is Silurian, according to the data obtained.

4.—*Minor Projects.*

The lack of technical assistance made it impossible to undertake the entire proposed program for 1944.

Through the co-operation extended by the Department of Public Works, gravel pit data have been compiled and the locations of all these gravel pits have been recorded on a map. A number of gravel pits have been investigated by J. A. Allan, and this study will be extended.

The entire mineral production and the separate mineral products from Alberta have been compiled and shown in graphical form.

Through the kindness of the Royal Canadian Air Force, and without cost to the Council, an airplane trip from Edmonton was made by J. A. Allan over a part of the northwest corner of Alberta. The surface conditions were observed especially from the west boundary of Alberta at Peace river, north and northeast to about township 100 in the Keg river district. No rock outcrops were observed and it is only along the larger stream courses that rock exposures might occur. The interstream areas are covered with muskeg, brush and light forest growth sparsely distributed and

widely burnt over. Geological field investigations in this part of Alberta will have to be confined to the drainage courses, at it would be a waste of time to traverse interstream areas.

In so far as time permitted and the information was available, fullest co-operation was extended to the many requests made to this office by geologists and engineers, by farmers, school teachers and citizens throughout Alberta. Many requests were from American engineers and geologists associated with northern development and with prospecting. A large number of requests were related to water supply for farms and towns and smaller hamlets. Several hundred specimens of minerals, rocks and fossils were sent in for determination.

Special attention has been given to a water supply for Grande Prairie. At the request of Mr. B. Russell, Director, Water Resources Branch, an examination was made of the surface geology around Bear Lake, and the foundation condition for a low dam on Bear river near the town of Grande Prairie. Field observations were also made of the water level in various lakes including Gull, Sylvan and Pigeon, and the water level was again checked in Gull lake.

Thankful acknowledgement is extended to Mr. T. H. Dalkin, Director, Technical Devision, in the Department of Lands and Mines, for photostatic facilities and for maps; and to Mr. John Crawford, Chief Inspector of Mines, for data on various coal deposits.

There is much geological field work to be done in Alberta, but until technical men with geological training are available it is not possible to increase the scope of the work undertaken.

NATURAL GAS RESEACH

The natural gas research under the Council is carried out under the direction of E. H. Boomer in the Department of Chemistry of the University of Alberta.

1.—*Vis-breaking of Alberta Bitumen.*

This project was commenced in October, 1943 and brought to completion in September, 1944. W. S. Peterson was employed continuously as research assistant on the project.

Two series of experiments were made. The first series was carried out in a small apparatus and gave preliminary results of promise. It appeared that with the apparatus used, bitumen could be reduced in viscosity by a factor of ten, without excessive coke or gas formation, by thermal treatment. The results have been reported in detail and may be summarized by stating the temperature should be about 485°C, the pressure, 400 lbs. per sq. in. gauge, and the time of holding under these conditions, 150 to 200 seconds.

A second series of experiments was carried out in a larger and more versatile apparatus permitting better control and the collection of better and more extensive data. Quantitative data on viscosity changes, coak formation, sulfur content and gas formation as a function of temperature, pressure and time were obtained. These results have been reported in detail.

For the particular apparatus used and the degree of control possible, it was found that best conditions were a temperature of 435 to 445°C, a pressure of 200 lbs. per sq. in. gauge, and a time of holding under these conditions of 200 seconds.

The results of this work show that a practical process of visbreaking of bitumen is possible without excessive coke or gas formation. The practical result is that the bitumen is converted from a highly viscous material difficult to handle except when hot to a material of viscosity sufficiently low to permit handling in the usual manner applicable to liquids.

2.—*The Fischer-Tropsch Synthesis of Liquid Fuels.*

This project was commenced in the summer of 1944. Two research assistants were employed in October, 1944, namely, J. H. Donald and D. Quon.

The Fischer-Tropsch synthesis is a process of producing liquid and solid and gaseous hydrocarbons, of which the first predominates, from "water-gas" mixtures. Water gas is a general term for mixtures of carbon monoxide and hydrogen and such mixtures are readily prepared on a large scale from natural gas, coal or coke.

While the process is in commercial operation in Germany, it is only now approaching economic success in competition with petroleum. Of the various problems that require solution before the process can be accepted generally on this continent as an alternative source of liquid fuels to petroleum, an important one lies in the catalysts used. This project is concerned with the improvement and development of catalysts.

No experimental runs were made in 1944. Equipment was designed, fabricated or purchased and erected to provide for water gas production and a battery of six catalyst testers. The major part of the equipment has been erected and tested. A start has been made on catalyst preparation. It is expected that all equipment, testing and control methods, operating technique and procedures will have been completed and runs started by late March, 1945.

PURIFICATION OF SILICA SAND FOR THE MANUFACTURE OF GLASS

This investigation under the Council was carried out by E. O. Lilge in the Department of Mining Engineering of the University of Alberta.

Silica sand is a product which has a wide variety of uses, but its greatest consumer is the glass industry. In Alberta the glass industry, representing an annual production to the value of about $1,500,000, consumes from 15,000 to 18,000 tons of silica sand a year. All of this sand in the past has been imported from Illinois at a price of from $6.00 to $6.50 per ton (peace time prices). About 65% to 75% of the total raw materials used in the manufacture of glass is silica sand and at the above quoted price this represents about 33% of the total cost of raw materials.

Although numerous silica sand deposits occur in Alberta, little is known about their extent and purity except that there is little likelihood that any of them can be used in glass making without some beneficiation. Two silica sand samples investigated were obtained from tar sand deposits, one at McMurray and one at Bitumount, 60 miles north of McMurray. They were sand tailings from the tar sands after the oil had been extracted by hot water. The investigations show that with a reasonable amount of processing a good glass sand can be produced from the tar sand tailings of the Bitumount deposits, but that the deposits at McMurray are likely to

be too fine and contain too high a percentage of titanium to make them suitable for use in glass making.

It is estimated that the cost of processing and freighting the sand from Bitumount to rail head at Waterways would be about $1.75 per ton. To market the sand at cost in Edmonton, Medicine Hat and Vancouver it is estimated would cost $3.95, $6.35, $10.75 per ton respectively. At these figures, silica sand produced at Bitumount could probably compete with Illinois sand on the Edmonton and Vancouver market, but not with prices of Illinois sand at Medicine Hat.

The possibility of establishing a glass factory at Bitumount is ruled out by the fact that many raw materials would have to be transported to the plant and the finished products would have to be transported long distances to markets. Fuel, which is a large item of cost in glass manufacture, would be higher at Bitumount than at Edmonton or Medicine Hat. It is estimated that by using the local fuel oil at Bitumount, the cost would be about $2.00 per ton of glass compared with 80 cents per ton (using natural gas) at Edmonton or Medicine Hat.

It appears that a solution to a big economic problem of the glass industry in Alberta would be the discovery of a good glass sand deposit centrally located in the province.

RURAL ELECTRIFICATION AND AGRICULTURAL ECONOMICS

The study of farm electrification with central station power was completed, and a full report published. "Rural Electrification in Alberta" by Andrew Stewart, Research Council of Alberta, Report No. 36. The full report consists of a main report, a statistical appendix, and a technical appendix. Fifty copies of each were prepared for distribution; and it has been necessary to restrict distribution to persons or organizations who can be expected to make good use of the report.

During 1944 two additional studies were undertaken at the request of the Alberta Power Commission, namely, (1) a study of the individual farm electric plant, and (2) a study of diesel plants in Alberta. Mr. A. R. Brown assisted with both studies. Preliminary reports were made to the Alberta Power Commission before the end of the year. Final reports are in preparation.

Further work was also undertaken by Prof. Stewart on behalf of the Alberta Post-War Reconstruction Committee. A draft of a report on "Crop Insurance", was sent to the Chairman, Sub-Committee on Agriculture, in December. Progress has also been made on a study of Agricultural Production Credit in Alberta. Prof. Stewart was active in planning the Alberta Post-War Survey which was organized in November; and since then has been a member of the Management Committee of the Survey. The Post-War Reconstruction Committee provided the services of Mr. W. G. Montgomery to assist in assembling material on the post-war needs of an expanding population in Alberta. Mr. Montgomery has assisted in the Post-War Survey, and in gathering additional material on which a report will be made later.

LIST OF PUBLICATIONS
of
RESEARCH COUNCIL OF ALBERTA
EDMONTON, ALBERTA

ANNUAL REPORTS OF COUNCIL

No. 3 (for the calendar year 1920); pp. 36. **(Out of print.)**
No. 5 (for the calendar year 1921); pp. 86. **(Out of print.)**
No. 8 (for the calendar year 1922); pp. 64. **(Out of print.)**
No. 10 (for the calendar year 1923); pp. 76. **(Out of print.)**
No. 12 (for the calendar year 1924); pp. 66. **Price 35 cents.**
No. 16 (for the calendar year 1925); pp. 65. **Price 35 cents.**
No. 20 (for the calendar year 1926); pp. 53. **Price 25 cents.**
No. 22 (for the calendar year 1927); pp. 49. **Price 25 cents.**
No. 24 (for the calendar year 1928); pp. 53. **Price 35 cents.**
No. 25 (for the calendar year 1929); pp. 65. **Price 35 cents.**
No. 26 (for the calendar year 1930); pp. 76. **Price 35 cents.**
No. 27 (for the calendar year 1931); pp. 53. **Price 35 cents.**
Nos. 28, 29 and 32 (for the calendar years 1932-1934); pp. 90. **Price 35 cents.**
No. 33 (for 1935); pp. 43. **Price 35 cents.**
Nos. 37-43 (for 1936-1942). Not published.
No. 44 (for 1943); pp. 14. **Price 5 cents.**
No. 45 (for 1944); pp. 18. **Price 5 cents.**

REPORTS—FUELS

No. 10A (1923); COMBUSTION OF COAL FOR THE GENERATION OF POWER, by C. A. Robb. **(Out of print.)**

No. 14 (1925); pp. 64. ANALYSES OF ALBERTA COALS, with 18 maps and 2 charts. By E. Stansfield, R. T. Hollies, and W. P. Campbell. **(Out of print.)**

No. 35 (1944); pp. 174. COALS OF ALBERTA—THEIR OCCURRENCE ANALYSIS AND UTILIZATION, by Edgar Stansfield and W. Albert Lang. In six parts. **Price $1.00.**

Parts 1-V—Occurrence, classification, production, special tests, general properties, preparation, utilization and combustion. **Price 50 cents.**

Part VI—Analytical and technical data by coal areas. **Price 50 cents.**

REPORTS—ROAD MATERIALS

No. 18. THE BITUMINOUS SANDS OF ALBERTA, by K. A. Clark and S. M. Blair.
Part I (1927)—Occurrence, pp. 74. **Price 25 cents.**
Part II (1927)—Separation, pp. 36. **Price 25 cents.**
Part III (1929)—Utilization, pp. 33. **Price 25 cents.**

REPORTS—SOIL SURVEY DIVISION

No. 23 (1930); PRELIMINARY SOIL SURVEY ADJACENT TO THE PEACE RIVER, ALBERTA, WEST OF DUNVEGAN, by F. A. Wyatt and O. R. Younge; pp. 33 and colored map. Scale 1 inch to 4 miles. **Price 50 cents.**

No. 31 (1935); PRELIMINARY SOIL SURVEY OF THE PEACE RIVER-HIGH PRAIRIE-STURGEON LAKE AREA, by F. A. Wyatt; with colored map. Scale 1 inch to 4 miles. **Price 50 cents.**

REPORTS—GEOLOGICAL SURVEY

By Dr. J. A. Allan, Professor of Geology, University of Alberta.

No. 1 (1919); pp. 104—A summary of information with regard to the mineral resources of Alberta. **Price 25 cents.**

No. 2 (1920); pp. 138+14. Supplements the information contained in Report No. 1. **(Out of print.)**

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