

Following the main road from Fraser's Range Station to Norseman, the basic rocks continued for about seven miles, when they gave place to granitic gneiss at what is known as the Ten Mile Rock.\* The gneiss at the Ten Mile Rock is vertical, and has an average strike of north 10 to 15 degrees east. At a rock hole 38 miles from the station a hornblende microcline granite (soda granite) [1/3704] occupies the country and continues as far westward as Buldania Rocks (A.8) to the north of Mount Northcott [1/3706]. The granite continues as far as Norseman, where its apophyses, the quartz-porphyrines and the soda-porphyrines (ceratophyres), penetrate all the rock series developed on the field other than the metamorphic sedimentary beds and the newer norite dyke.

Chemical analyses of the two soda-granites and two gneisses were made in the Government Chemical Laboratory, under the direction of Dr. E. S. Simpson; these are given in Table III. hereunder.

TABLE III.

*Chemical Analyses of some Rocks from the Country between Mount Ragged Range and Norseman.*

Registered No., Name, and Locality.	1/3702. Biotite gneiss, Pine Hill.	1/3697. Microcline biotite gneiss, Junana Rocks, North West of Mt. Ragged.	1/3704. Soda granite, Rock Hole, 38 miles East of Fraser's Range Station.	1/3706. Soda granite Buldania Rocks (A.8).
SiO <sub>2</sub> ...	75.00	73.23	71.32	69.88
Al <sub>2</sub> O <sub>3</sub> ...	12.57	12.78	15.14	15.18
Fe <sub>2</sub> O <sub>3</sub> ...	.85	1.06	.87	1.21
FeO ...	1.00	1.98	.54	1.19
MnO ...	.15	.15	.08	.12
MgO ...	.17	.50	.43	1.13
CaO ...	.87	1.27	1.47	2.86
Na <sub>2</sub> O ...	2.90	3.66	5.25	4.78
K <sub>2</sub> O ...	5.82	4.92	3.14	2.15
H <sub>2</sub> O — ...	.04	.03	.16	.06
H <sub>2</sub> O + ...	.23	.46	.40	.60
TiO <sub>2</sub> ...	.24	.48	.11	.31
P <sub>2</sub> O <sub>5</sub> ...	.07	.17	.57	.15
CO <sub>2</sub> ...	<i>Nil</i>	.02	.20	.04
FeS <sub>2</sub> ...	<i>Nil</i>	<i>Nil</i>	<i>Nil</i>	trace
S ...	...	...	.13	...
Less F ...	...	...	99.61 0.06	...
	99.91	100.71	99.55	99.66
Sd. Gr. ...	2.63	2.66	2.65	2.68
Mode ...	Microcline Quartz Oligoclase Biotite Magnetite Limonite Sphene Apatite Riebeckite (?) Garnet (?)	Microcline Oligoclase Quartz Orthoclase Biotite Hornblende Sphene Magnetite Calcite Apatite Riebeckite	Oligoclase Quartz Microcline Hornblende Biotite Apatite Magnetite Calcite Sphene Fluorite Limonite Kaolin	Oligoclase Quartz Microcline Biotite Hornblende Epidote Muscovite Zoisite Sphene Magnetite Ilmenite Apatite Limonite Zircon
Class ...	I.—4 (3), 1 (2), 3 Liparose, near Alaskose and Toscanose	I.—4, 1(2), 3 Liparose, near Toscanose	I.—4, 1, 4 Kallerudose	I.—4, 2, 4 Lassenose
Analyst ...	D. G. Murray.	D. G. Murray.	H. P. Rowledge.	J. N. A. Grace.

In addition to the magnetite and manganese referred to in the report by Mr. Woodward, previously quoted, ilmenite (titanite of iron) occurs in some portion of Fraser's Range, for a sample of this was handed to me while at the head station. No opportunity, however, presented itself of making an examination of the locality from which the mineral was obtained.

#### 4.—THE GYPSUM DEPOSITS AT DUKIN, AVON DISTRICT, SOUTH-WEST DIVISION.

(F. R. FELDTMANN.)

##### GEOGRAPHY.

*Location.*—Dukin Siding is situated in the Avon District on the Wyalcatchem-Mount Marshall branch railway about 115 miles NE. of Perth, as the crow flies, and approximately 159 miles by rail. It is close to the southeastern edge of Cowcowing Lake, a large and, in this area, comparatively well-defined salt lake, extending in a southwesterly direction.

Mineral Claim 29H—the only area being worked during my visit—is situated on the southeastern edge of the lake from half a mile to a mile north of the siding. It is within Location 16454,† formerly held by the Plaster of Paris and Gypsum Company, Ltd., and adjoins part of the western boundary of Lot 124.

*Topography and Vegetation.*—The surrounding country is gently undulating, there being no hills of any size. There is, for the most part, a gentle slope towards the lake, but in places the lake is fringed by fairly steep, but comparatively low, banks.

The chief timber is salmon gum, which is fairly thick on those areas left uncleared. Some small areas of ti-tree occur along the edge of the lake.

*Geology.*—The country is largely covered by detrital material, the surface soil being of a fairly light sandy character. A few fragments of travertine were seen in places.

The underlying rock is, without doubt, granite, but only one small outcrop, on the northwest shore of the lake at a point 3¼ miles NW. of the siding and immediately north of the re-entrant angle of Location 18932, was seen. This outcrop was in the form of a low breakaway, and consisted of much decomposed granite, showing incipient laterisation at the surface.

*The Gypsum Deposits.*—Cowcowing Lake consists, in the vicinity of Dukin, of a number of small clay pans, either more or less oval in shape, or forming narrow winding channels, of which one follows the southeastern edge of the lake. These clay pans are separated by low irregular banks composed chiefly of fine clay and sand, with some gypsum in the form of crystals or the earthy variety kopai, and in places small gasteropod shells and fragments thereof.

The bed of the clay pans consists of a dense, fine, puggy grey clay, extending in potholes in Mineral Claim 29H to a depth of about five feet. A pothole a few feet from the edge of the lake shows the material underlying the grey clay to consist of clay of paler and more reddish colour, containing a large proportion of quartz grains. This deposit was exposed to a depth of about four feet, but no information was available as to its total depth.

The gypsum deposits appear to be chiefly confined to the southeastern side of the lake. In the dry season the floor of the clay pans on this side of the lake, with the exception of the lowest-lying portions, is covered by a layer of gypsum, mainly of the seed type. This layer ranges in thickness from a mere film to nearly a foot. The main deposit on Mineral Claim 29H is usually from four to six inches in

\* Lands and Surveys Department Lithograph 18/300.

† Vide Lands and Surveys Department Lithograph 56/80.

thickness. The surface portion of the deposit is fairly white and pure, but the lower portion contains a proportion of fine clay, increasing with the depth. As a rule, only the top two inches is taken off, and this is roughly washed before bagging for transit.

The lowest portions of the clay pans are usually covered by a thin film of salt.

The water level in the dry season is approximately one to two feet below the surface. The water is extremely salt, and in places contains gypsum in solution, as may be seen by the growth of gypsum on grass tufts blown into the potholes.

The extent of the gypsum deposits is said to vary from year to year. One portion of the southeastern channel which was said to be covered by a salt film the previous year was, at the time of my visit, covered by a layer of coarse seed gypsum.

A few shallow potholes near the northwest corner of the claim, in a low bank forming the western edge of the southeastern channel, disclosed a layer, at a depth of about  $1\frac{1}{2}$  to 2 feet, containing, in some of the potholes, fairly well developed, usually single, crystals of clear gypsum up to  $2\frac{1}{2}$  inches in length and  $1\frac{1}{2}$  inches in diameter. Some of the crystals are markedly elongated, one, two inches in length, having a diameter of not less than one-fifth of an inch. In other potholes the gypsum is of a rounded flake-like form.

In places, on the southeastern edge of the lake, are irregular narrow banks of seed gypsum, evidently wind-blown. These banks are probably several feet thick in places. The gypsum composing them is cleaner than that on the floor of the clay pans, but the presence of numerous small bushes, the roots of which penetrate the gypsum, would interfere with the working of this deposit to some extent.

In a few places, for example near the northwest and southwest corners of Lot 124, there are fairly high dunes on or near the edge of the lake. Unlike the dune fringing the southeastern portions of the gypsum lakes at Hine's Hill, where the composing material consists largely of seed gypsum, these dunes are composed mainly of kopai, that composing the dune near the southwest corner of Lot 124 being almost pure. A shallow pothole near the bottom of the western slope of this dune shows the kopai, at this point, to be underlain by discoloured seed gypsum, apparently to a depth of several feet.

As at Hine's Hill, the position of the dunes and of the low banks of seed gypsum indicates that the prevailing wind is from the northwest.

About  $1\frac{1}{2}$  miles SW. of Mineral Claim 29H and 24 chains WNW. of the southwest corner of Lot 125, a deposit characterised by unusually large gypsum crystals has been cut in a shallow trench at the foot of a low bank on the lake. The gypsum is distributed as large crystals of arrowhead or of elongated spearhead form, or as irregular aggregates of these forms, mostly arranged with their longer axes nearly vertical, in a band of very puggy grey clay. This band is from  $1\frac{1}{2}$  to 2 feet thick and is covered by an overburden, from a few inches to about 2 feet thick, of fine, dusty clay. The base of the gypsum deposit is at about water-level in the dry season. The deposit is underlain by dense, puggy clay. The largest mass of gypsum seen in this deposit was about  $2\frac{1}{2}$  feet in length, and was composed of two

imperfect crystals, joined irregularly. The crystals are mostly imperfect, but one nearly perfect arrowhead measuring about  $11\frac{1}{2}$  inches in length by  $5\frac{1}{4}$  inches in maximum width was obtained, and also a crystal of the spearhead type measuring  $16\frac{3}{4}$  inches by a little more than one inch. The crystals are fairly clear, but some are stained slightly brownish, probably by organic matter, and contain small inclusions of clay, arranged parallel to the re-entrant angle of the crystals.

Owing to the difficulty of working this last deposit, and particularly of separating the crystals from the dense, puggy clay, it is unlikely that it will prove payable.

## 5.—RECENT DISCOVERIES AND DEVELOPMENTS AT THE NORTH END, KALGOORLIE.

INCLUDING THE SURPRISE NORTH CROSS LODGE AND THE PAYMASTER LODGE.

(F. R. FELDTMANN.)

During the recommencement of the Kalgoorlie survey, it was considered advisable to examine some of the work done at the North End since the survey by myself of that area, the results of which were given in Bulletins 51 and 69 of the Geological Survey, and since my brief visit in 1917. It was hoped that an examination of the recent work, in particular that in the vicinity of the largest albite porphyrite dyke (*vide* Bulletin 69, page 39), which runs through the middle of the Younger Greenstone belt, would supply information that was not available at the time of my original survey. The area occupied by, and that for some distance east of, this dyke, particularly to the north of the Transcontinental Railway, is almost completely obscured by superficial deposits, and at the time of the original survey but few shafts in that area were of sufficient depth to give any indication as to the nature and relative positions of the rocks. From the appearance of the material on some of the dumps north of the Kanowna railway, the presence of a second albite porphyrite dyke, east of the main dyke, was suspected, but no data were available as to its strike and extent. The mining work done since my survey affords a considerable amount of information, still unfortunately incomplete, as to the occurrence of this dyke, as well as of the main dyke and associated lodes.

The leases examined in most detail were the Surprise North G.M.L. 5193E and the Paymaster and Paymaster Proprietary G.M.Ls. 5333E and 5167E, adjoining the Surprise North on the northeast and southeast respectively. The northwestern boundary of the Kanowna Railway Reserve forms the southeastern boundary of G.M.L. 5193E, and that of the Transcontinental Railway Reserve, the southeastern boundary of G.M.L. 5333E. The southeastern boundary of G.M.L. 5167E runs a few feet northwest of the Transcontinental Railway Reserve.

THE SURPRISE NORTH G.M.L. 5193E. (Plate I.)  
General Geology.—This lease, which is held by Mr. M. Hartigan, covers part of the southern portion of former G.M.L. 4461E (4419E), Lone Hand No. 2 (Bulletin 51, pages 42 and 43; Bulletin 69, Plate XIII, sheet 10), and part of the western portion of former G.M.L. 4146E (1121E), Devon Con-