A qualitative analysis of the micaceous mineral proved the presence of SiO_2, Al_2O_3, CaO, MgO, Na_2O and H_2O. It has a specific gravity of 3.03, determined with CH_2I_2 on the fine powder. Scales under the microscope show a low birefringence on the basal plane, with a biaxial figure with rather large 2E. These results are typical of margarite.

The granular massive corundum varies from pale to dark grey in colour. One of the cleanest fragments has a specific gravity of 3.8, a low result for corundum due to microscopic pores and inclusions. Under the microscope it is transparent and mostly colourless, but occasional fragments or portions of fragments are sapphire blue in colour. No crystals were observed in the 0.25 mm. powder, but occasional prism and pyramid faces a few mm. long are to be seen on some of the hand specimens. The hardness is typical.

(6) REINITE AND SCHEELITE, JIMPERDING, S.W.

$FeWO_4$ occurs almost exclusively in nature in forms belonging to the monoclinic system, and known as ferberite. In 1878, however, some tetragonal crystals of this compound were found at Mt. Kimbo in Japan and described as a new species under the name of Reinite. Doubt has since arisen as to whether the tetragonal form is natural to $FeWO_4$ or only arises by replacement of crystals of scheelite ($CaWO_4$) by the corresponding iron compound. In this case reinite would not be an independent species.

In a quartz reef which was opened up in 1930 in search of gold in the Jimperding Valley, several tetragonal crystals of reinite were found which are undoubtedly merely pseudomorphs after scheelite, since in several of them part of the original yellow scheelite is plainly visible. The crystals range from 5 to 20 mm. in length and are simple unit bipyramids in form. Angles calculated and measured on the largest crystal are—

	p^1p^2	p^1p_1
Calculated ...	... 79°55′	49°27′
Measured ...	... 80°	50°

This crystal weighed 6 grms. and had a specific gravity of 6.73 as compared with 6.10 for scheelite and 7.40 for ferberite.

Cross fractures show in most of the crystals a number of small remnants of yellow scheelite embedded in the brownish black reinite. The surface portions have been almost completely altered, scheelite only rarely showing in quite small areas.

Reinite does not appear to have been previously observed anywhere in the Commonwealth.

(7) VARISCITE (REDONDITE) AND LEUCOPHOSPHITE (Sp. nov.), NINGHANBOUN HILLS, S.W.

At the extreme eastern end of the Ninghanboun Hills, on the shore of Lake Weelhamby (a large salina), is a knoll of sepentine reaching to about 100 ft. above the lake level. The rock in this hill is extraordinarily dismembered by three sets of cracks approximately at right angles to one another,

and following the east and west cracks are two vertical veins about 2 ft. wide, passing over the summit of the hill about 30 ft. apart, and filled with a multicoloured mass of phosphates. The filling is not wholly confined to the two main seams, but extends from them for a greater or less distance into the other series of cracks, a considerable mass showing in a horizonal seam on the east side of the hill.

The veins are vughy or cavernous, some spaces being large enough to admit a man or a wallaby, a few of which obviously frequent them. On a smaller scale the filling is found to be porous, varying in texture from that of a hard or soft chalk to pumiceous, or crustiform with longitudinal crevices. The colour covers a wide range from almost pure white, through greyish-white and greenish-white to French green (R 35″ i), Montpellier green (37″ i) and nickel-green (37″ m) in one direction, and through various tints of pinkish buff and lighter brown to hair-brown (R 17^{4} i) in another. Green is the more common colour.

Despite the apparent wide range of material contained in the veins, actual analysis shows the filling to be almost wholly redondite, a ferriferous variety of variscite, intimately mixed with granular chalcedony and opal. The varying colour appears to be due to uneven distribution of staining agents, chromium phosphate being responsible for the various shades of green, and iron and possibly manganese compounds for the buff and brown. The purest variscite, as well as that which contains appreciable quantities of isomorphous ferric phosphate, is apparently white.

A close examination of the structure of the filling reveals several stages in the deposition of the phosphates associated with corresponding colour variations. It is quite plain that much of the present filling is a replacement in situ of angular blocks of the serpentine, ranging in size from a few millimetres to many centimetres in diameter. In an excavation on the northern vein are exposed one or two large blocks of the dark green rock which were fresh in the centre but have been altered into a grey mixture of variscite and chalcedony to a depth of about a centimetre all round. Such a crust was found to contain 3.69 per cent. of P_2O_5 and 64.32 per cent. of silica. Other large boulders have been completely phosphatised, but show remnants of their original structure, particularly of a subfibrous actinolite. A typical specimen of this nature is mottled white, pale green and pale brown in colour, carrying in bulk 6.86 per cent. of P_2O_5 and 62 per cent. of silica and insoluble silicates. It is traversed by veinlets of dull green opal.

The brightest green material in the deposits is almost wholly in angular fragments, both small and large, and more rarely in lamellar, crustiform, masses. The angular masses, which are obviously replacements, are embedded in a porous mass of white or tinted material, which will be referred to as the matrix.

A third structural feature is the presence of a fair number of sharply defined veinlets in the matrix, from a millimetre or two, to one or two centimetres in width. The narrowest of these are often filled with opal, the wider ones with buff or brownish redondite, a typical veinlet carrying 27.55 per cent. of acid soluble P_2O_5 combined with alumina and iron, and contaminated with 23 per cent. of silica, no lime being present.

Dealing with the chemical composition of the vein filling it is to be remembered that variscite, $AlPO_4.2H_2O$ and strengite, $FePO_4.2H_2O$ are completely isomorphous, and a complete series of intermediate cocrystallisations are known. Of these the ferriferous varieties of variscite have been called redondite, and the aluminous varieties of strengite, barrandite. $CrPO_4.2H_2O$ in small quantities is present in many occurrences.

One very white, chalk-like mass from the matrix, proved on analysis to be a mixture of granular chalcedony and a hydrous phosphate of potassium, iron and aluminium, the iron predominating over the aluminium. Its analysis is given in column 3 of the table. Such a mineral has not previously been recorded, though a related mineral is known, viz. minervite, a hydrous phosphate of potassium and aluminium with traces of iron replacing part of the aluminium. The formula of minervite is not definitely known, but may be approximately $H_2KAl_2(PO_4)_3.7H_2O$.

A typical specimen of the new Ninghanboun phosphate taken for analysis was found to contain insoluble matter amounting to 55·33 per cent. made up as follows:—

	per cent.
Chalcedony, quartz and traces of combined SiO_2 ...	52·75
Chromite	1·07
Rutile	·48
Carbon, etc.	1·03

The remaining figures yield the formula:—

$$K_2(Fe,Al)_7(OH)_{11}(PO_4)_4\cdot 6H_2O.$$

This compound is insoluble in water, but wholly soluble in hot strong HCl. In view of the large deductions and single analysis the formula is tentative. Neither can its physical properties be closely defined owing to its porosity and intimate contamination, but by heavy solutions its specific gravity has been shown to be between 2.30 and 2.65. In mass the mineral is white in colour and chalky in texture. Under the microscope it is minutely granular and birefringent and practically inseparable by eye or by heavy solutions from the accompanying granular chalcedony. As indicated above its minor contaminations are chromite, rutile, opal, carbonaceous matter, and possibly talc or serpentine. The type specimen is being divided between the British Museum, the Western Australian Museum and the writer's collections.

A second specimen of similar texture, by its mottled pale green tint merging into white, was plainly contaminated with chromiferous redondite, as well as with 46.9 per cent. of silica. It was found to contain, after rejecting the silica, P_2O_5, 36.63 per cent.; K_2O, 4.65 per cent.; $(NH_4)_2O$, 0.04 per cent. This indicates a mixture of about 55 per cent. of the new mineral with 45 per cent. of redondite.

The presence of distinct traces of ammonia in the mineral is noteworthy. A second series of chips from the first analysed specimen gave 0.05 per cent. $(NH_4)_2O$ with only 38 per cent. of insoluble silica.

No previously described mineral approaches this in composition except minervite, a potassium aluminium phosphate, from which it differs in possessing a much greater basicity, a lower ratio of K to (Al + Fe), and finally a molecular preponderance of iron over aluminium. It appears therefore to be a new species for which the name Leucophosphite is suggested (Gr. *leukos,* white; *phosphoros,* the root of phosphate).

PHOSPHATIC MINERALS, NINGHANBOUN.

No. ...	(1)		(2)		(3)	
Mineral ...	Redondite.		Redondite.		Leucophosphite.	
Colour ...	Brown.		Green.		White.	
	%	mols.	%	mols.	%	mols.
Al_2O_3	17·81	175	20·45	201	12·73	125
Fe_2O_3	17·66	110	12·66	79	32·82	206
Cr_2O_3	tr.	—	·73	5	nil	—
FeO	·03	4	·20	3	nil	—
MnO	·27		nil	—	·22	3
MgO	·27	7	nil	—	·73	18
CaO	nil	—	nil	—	tr.	—
$(NH_4)_2O$ ...	tr.	—	tr.	—	·09	2
Na_2O	·19	3	tr.	—	·13	2
K_2O	·29	3	·96	10	7·88	84
H_2O + ...	19·82	1100	20·98	1164	12·28	681
P_2O_5	40·23	283	42·19	297	26·69	188
NiO	—	—	nil	—	tr.	—
CO_2	—	—	nil	—	·17	—
Carbon ...	nil	—	nil	—	tr.	—
SiO_2	1·92	—	nil	—	nil	—
TiO_2	·45	6	·21	—	nil	—
H_2O — ...	1·14	63	1·97	109	6·59	366
	100·08		100·35		100·33	
G	2·60	...	2·44	...	2·45±	...

Analyst—D. G. Murray.

(1) After deducting 24·44% quartz and chalcedony, 0·45 % rutile, 0·59% chromite.
(2) After deducting 0·76% quartz and chalcedony, 0·20% rutile, 0·26% chromite.
(3) After deducting 52·75% quartz and chalcedony, 0·48% rutile, 1·07% chromite, and 1·03% carbon, etc.

Apart from the two masses just described, all the other specimens collected from these veins proved on analysis to consist essentially of ferriferous variscite (redondite) contaminated with finely granular chalcedony and opal. Complete analyses were made of two very different looking specimens of the mineral. One was a large bright green (about 37″a) angular fragment picked out of a buff coloured matrix in the northern vein. The analysis is given in Col. 2 of the Table. The green colour is obviously due to the presence of $CrPO_4.2H_2O$. Other green specimens were partly analysed to confirm this impression, the figures obtained being:—

REDONDITE, NINGHANBOUN.

Colour:	Bright green.	Brown spotted with white and green.	Green and brown mottled.	Green, brown and white banded.
P_2O_5	37·93	12·72	39·07	36·50
F_2O_3	12·64	7·94	17·58	19·07
Cr_2O_3 sol. in HCl	·71	·20	·53	·42
Cr_2O_3 insol. in HCl	·31	·06	·37	·28
Insol. SiO_2, etc. ...	4·32	60·49	2·61	5·56

In each instance the insoluble Cr_2O_3 was shown to be present as granular chromite, a mineral found throughout the serpentine mass.

The other specimen analysed (Col. 1) was portion of a hair-brown, hard, slightly scoriaceous mass forming a lens in the southern vein. This also proved to be redondite, but differed from the green mineral in containing more iron as well as a little manganese and magnesia. No acid soluble chromium was present, but fine granules of chromite were distributed through the mass as in all the other specimens analysed. A section made of this material discloses a greenish brown base of minutely granular birefringent redondite in which are set rounded grains of phosphatised rock with angular and rounded quartz grains and black chromite, as well as an occasional cavity filling of chalcedony.

The small amount of acid soluble potash in both (1) and (2) suggests the presence of a small proportion of the new mineral leucophosphite in intimate association with the variscite.

The problem of the origin of the veins presents many points of interest. The nature of the enclosing rock, the many evidences of replacement of it by the vein filling, and the absence of lime, rule out sedimentary beds of organically derived apatite, or crystalline veins or pockets of apatite of the Canadian or Norwegian type. An origin to be considered is a vein or veins of pegmatite carrying such phosphatic minerals as amblygonite, childrenite, triphylite or zwieselite. Such minerals are, however, invariably associated with considerable quantities of coarsely crystallised quartz, felspar, mica, etc., no remnants of which, or of possible pseudomorphs after them, could be seen at Ninghanboun.

The Author's explanation is as follows:—

In recent geological times Weelhamby Lake was a lake in fact as well as in name, and carried abundant living organisms, fish, crustacea, etc., attractive to such birds as cormorants. The serpentine hillock, right on the water's edge, having a wide outlook, and being almost barren of soil and vegetation, formed a convenient roosting ground for large flocks of such birds. Their guano collected on the surface of it and in solution and suspension was carried into the numerous cracks in the rock, particularly into two which were rather larger than the others and reached to the very summit of the hillock. The chemically active ammonium phosphate of the guano attacked the susceptible serpentine, chlorite and other silicates of the rock, producing as the end product of a series of reactions, the highly stable aluminium-iron phosphate redondite in the form of replacement veins and fissure fillings.

The arguments in favour of this theory, apart from its inherent possibility, and the previously stated arguments against a derivation from the normal apatite bed or vein, or a phosphatic pegmatite, are the following:—The abundant evidence of the replacement of the serpentine rock owing to attack by a soluble phosphate. This evidence is both structural and constitutional, especially the presence of pseudomorphs after amphibole and visible partial and complete replacements of masses of the serpentine rock. Again there is the regular distribution of granules of chromite through all the specimens examined. Another point of evidence is the presence, in all specimens, of angular and rounded granules of quartz and rarely microcline, both foreign to the matrix but such as might be carried to their roost by the

birds on their feet. Furthermore, distinct traces of ammonia were detected in such specimens as were examined for it. Finally, certain obscure structures in the veins appear to be chalcedony or opal pseudomorphs after fragments of mollusc shells. It is to be noted that the redondite of Martinique and Redonda Is. is considered to have been produced by the action of guano on andesite; that of Clipperton Is. by similar action on trachyte; the variscite of Connetable Is. from the same action on amphibolite; and the minervite of Reunion Is. from the same action on basalt.

SUMMARY.

A description is given of the occurrence and physical and chemical properties of (1) Chrysoberyl and associated minerals (Cummingtonite, etc.) at Dowerin, this being the first record of Chrysoberyl in the State; (2) Columbite and Tapiolite at Jimperding; (3) Corundum in the Lower Chittering Valley; (4) Diopsidé at Nevoria; (5) Margarite and Corundum at Gibraltar and Nevoria, the first record of Margarite in the State; (6) Reinite and Scheelite, Jimperding, the first record of Reinite in the State; (7) Variscite and Leucophosphite (a new hydrous phosphate of potash and iron) at Ninghanboun, the first record of both in the State.

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