2021

MAKATEA PHOSPHATE PROJECT

NI 43-101 Independent Technical Report for the Makatea Phosphate Project, French Polynesia

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Contents

List of Tables

List of Figures

Acronyms

AusIMM	Australasian Institute for Mining and Metallurgy
Avenir Makatea	Avenir Makatea Pty Ltd
CFA	carbonate fluorapatite
CFPO	Compagnie Française des Phosphates de l'Oceanie
cm	centimetre
DQO	data quality objective
DTM	digital terrain model
ERP	exploration research permit
ha	hectare
ISO	International Organization of Standardization
ITR	Independent Technical Report
km	kilometre
km^2	squared kilometre
km^3	cubic kilometre
LiDAR	Light Detection and Ranging
m	metre
mm	millimetre
Mm^3	million cubic metres
Mt	million tonnes
Mya	million years ago
P_2O_5	phosphate
PTPU	Pae Tai Pae Uta
pXRF	portable X-ray fluorescence
QA	Quality Assurance
QAT	Quality Acceptance Testing
QC	Quality Control
QP	Qualified Person
RSC	RSC Consulting Ltd
SASAM	SAS Avenir Makatea
SOP	standard operating procedures
USGS	United States Geological Society
wt.%	weight percent

1 Summary

Avenir Makatea Pty Limited (Avenir Makatea) on behalf of Chatham Rock Phosphate Limited (Chatham Rock or 'the Issuer') commissioned RSC Consulting Limited (RSC) to carry out an Independent Technical Report (ITR) for the Makatea Phosphate Project (the project) compliant with Canadian National Instrument 43-101. This report documents the exploration work completed on the project, including all technical background information and full analysis of the data. This report can therefore be used as a stand-alone document. The effective date of the report is 15 April 2021.

1.1 Project Description and Ownership

The Makatea Phosphate Project is located on Makatea Island, approximately 240 km northeast of Tahiti, French Polynesia. The project covers an area of 1,036 ha (10.36 km^2). Access to Makatea Island is via boat or helicopter. There is one unsealed road linking Port Temao to the village and the Bay of Moumu. All other access is by foot.

The island is a well-known source of phosphate and was previously mined by Compagnie Française des Phosphates de l'Oceanie (CFPO) from 1918–1966.

SAS Avenir Makatea (SASAM) is a 100%-owned subsidiary of Avenir Makatea Pty Limited. SASAM was granted an exploration research permit (ERP) for the exploration of phosphate on 28 January 2014 for a term of three years. In 2016, SASAM applied for a mining concession and is still waiting for a decision on its application.

The shareholders of Avenir Makatea entered into a share purchase agreement with Chatham Rock dated 28 April 2021 pursuant to which Chatham Rock, an arm's length party to Avenir Makatea, agreed to purchase all of the issued and outstanding shares of Avenir Makatea in exchange for 17,857,738 common shares of the Issuer, having a total deemed value of CAD1,455,000 (AUD1,500,000). Closing of this transaction is subject to various conditions precedent, including the approval of TSX Venture Exchange. Upon closing of this transaction, Chatham Rock would then hold Makatea Phosphate Project through Avenir Makatea as its wholly-owned subsidiary.

1.2 Geology and Mineralisation

Makatea Island is composed of four major stratigraphic units including an Early Miocene series, a Miocene-Pliocene series, Pleistocene unit and Holocene unit (Montaggioni et al., 1985; Montaggioni & Camoin, 1997; Brown, 2011). These four units consist of a range of carbonate rocks including bafflestone, packstone, wackestone, grainstone, and boundstone. Post-depositional dolomite alteration occurred locally over parts of the Makatea reef platform. Dolomitisation is thought to be related to the fluctuating freshwater-saltwater interface, likely caused by eustatic sea-level changes (Montaggioni & Camoin, 1997). Relative sea level decreased several tens of metres during the middle Miocene to expose the carbonate/dolomite. Carbonate dissolution by meteoric water caused karstic alteration of the carbonate/dolomite forming the characteristic topography of the island. At the same time, dolomitisation intensified as dolomitising fluids were able to penetrate the limestone core (Montaggioni & Camoin, 1997). The island has undergone three periods of uplift and is now raised ~70 m above sea level.

Primary phosphate deposits form through the precipitation of carbonate fluorapatite (CFA) within marine sediments, at the sediment-water interface or during diagenesis. At Makatea, there is no consensus on the primary controls on phosphate precipitation; however, the mineralisation is interpreted to be caused by to endo-upwelling of cold seawater and the potential influence of bacterial processes in cyanobacterial ('kopara') mats. Reworking of the primary phosphate by bottom currents can form secondary granular phosphorites, such as conglomerates or sandstones. During the late Miocene to early Pliocene, phosphate precipitation initiated and, as karstic weathering of the dolomite/carbonate intensified, the phosphate was redeposited into the karst cavities.

The phosphate occurs as several different units at Makatea (Brown, 2011), including:

- loose sand with phosphate nodules, pebbles and block;
- bedded, hard pisolitic phosphorites which underlie the barren limestone cap, often visible on the inside of the karst holes; and
- hard, light-brown, well-cemented, brecciated phosphate.

The phosphate is predominantly phosphate sand, which fills, or previously filled in the cases of the historical mining area, pits or holes formed by the karstic weathering. In places, the phosphate is hardened and interbedded with the overlying limestone/dolomite. The phosphate is discontinuous and appears as irregular-sized pockets.

1.3 Exploration

Avenir Makatea started exploration for phosphate mineralisation at Makatea in 2011 with a reconnaissance sampling programme. The programme included the collection of 63 surface samples including test material found within the ruins of old ore bins. Following the sampling programme, SASAM was granted the ERP and conducted an additional two sampling programmes.

A preliminary diamond drill programme was conducted during August 2014. The objective of the drill programme was to:

- confirm the exploration potential;
- provide geological evidence to advise exploration targets; and
- assess the most practical exploration methods for a future programme.

The drill programme consisted of 13 drillholes, for a total of 61.65 m of drilling. Recovery was poor, due to the use of water to flush the drill bit, resulting in the loss of soft, unconsolidated to semi-unconsolidated material. Only one drillhole (MKDH0005) recovered phosphate material as it was specifically collared to sample a 15-cm-thick band of phosphatic sand.

A reconnaissance, sinkhole and traverse sampling programme was conducted from April to May 2015 and included:

- the reconnaissance of sinkholes;
- established procedures for field sampling;
- established procedures for pXRF analysis; and
- sampled and logged sinkholes.

Samples collected included a mix of phosphorites, limestone and dolomite. The samples identified as 'phosphorite' have an average P_2O_5 concentration of 33.2% (using a P_2O_5 lower cut-off grade of 18%) and a Ca:P_2O_5 ratio of 1.6. The phosphorite has very low impurities (0.44% Fe_2O_3, 0.05% Al_2O_5, and 0.06% SiO_2); however, limited trace element analysis data shows some of the phosphorite samples have elevated cadmium (Cd) concentrations (up to 78 ppm).

SASAM applied limited quality control, and these data were not available for RSC to review. No prescriptive standard operating procedures (SOPs) for the 2011 and 2014 sample/drill programmes were available for RSC to review. While these were not available, the QP regards the sample preparation, analyses and security undertaken to date as fit for the purpose of early-stage exploration and the identification of exploration targets.

1.4 Mineral Resources

No Mineral Resources are presently defined within the Makatea Phosphate Project.

1.5 Conclusions

For the purpose of defining an exploration target, SASAM's practices are considered appropriate by the QP. There are some shortcomings in SASAM's drilling, sampling, QA and QC practices that are outlined in sections 11 and 12 of this report. While the project has been successfully exploited historically, further fit-for-purpose exploration work is required to determine the size and grade of the remaining phosphate deposit.

1.6 Recommendations

RSC makes the following recommendations:

- Compile all exploration data into a digital database.
- The drilling programme produced poor recoveries. To advance the project, RSC recommends completing drill programme using a small footprint sonic rig. However, due to the remote nature of the project and irregular topography, the logistics of transporting a sonic drill rig need to be carefully considered.
- RSC recommends an SOP is created that captures chain-of-custody of samples once they leave the field, during sample preparation and prior to dispatch to ALS.
- Repeat samples and CRMs should be collected and inserted into the sampling process, and robust SOPs should be in place to ensure that all future data are fit for purpose.
- Improved surveying techniques (collar and down-the-hole) should be put in place for any future resource definition drilling.
- Density and moisture content data need to be collected as part of further drill programmes. The sampling method should be identified in a prescriptive SOP.
- Portable XRF (pXRF) data can play an important role in the collection of cheap, rapid, early-stage geochemical data at Makatea. All samples should be re-analysed with a pXRF, following industry best practices.

- Conduct a DTM survey that can better capture the karst holes. This may require a mixture of LiDAR, cavity monitoring systems and conventional surveying.
- Undergo a mapping programme to map the lateral and vertical extent of all known outcrops of phosphorite. Map out the historically mined areas.
- Complete a full marketing study looking at the specifications of the phosphate ore and its ability to be upgraded. The study should also investigate at the potential for ore dilution, in terms of the introduction of deleterious elements.

2 Introduction

Avenir Makatea Pty Limited (Avenir Makatea) on behalf of Chatham Rock Phosphate Limited (Chatham Rock or 'the Issuer') commissioned RSC Consulting Limited (RSC) to carry out an Independent Technical Report (ITR) for the Makatea Phosphate Project (the project) and prepare a technical report (the report) compliant with Canadian National Instrument 43-101. This report documents the exploration work completed on the project, including all technical background information and a full analysis of the data. This report can therefore be used as a stand-alone document. The effective date of the report is 15 April 2021.

The Makatea Phosphate Project is located on the island of Makatea, in the Tuamotu Archipelago of French Polynesia. Makatea Island is located ~240 km northeast of Tahiti. The Makatea Phosphate Project lies over almost half of Makatea, along the length of the northeast coast. The project covers an area of 1,036 ha (10.36 km^2). The island is a well-known source of phosphate and was previously mined until 1966.

For this project, RSC has undertaken a thorough review of all available data and reports, completed a review of sample procedures, validated available data, and provided a summary, interpretation and recommendations.

2.1 Personnel

The work completed by RSC, and the subject of this report, was carried out by the following people.

- **René Sterk** is the managing director of RSC, an independent consulting group based in Dunedin, New Zealand and one of its principal geologists. He is a Fellow and a Chartered Professional Geologist (CP(Geo)) with the AusIMM. Mr Sterk holds an MSc in Structural Geology and Tectonics from the Vrije Universiteit Amsterdam, Netherlands, (2002). He is the Qualified Person with overall responsibility for all sections of this report except section 2.4.
- **Llyle Sawyer** manages the Uranium and Strategic Metals Group at GM Minerals Consultants Pty Ltd (trading as Geos Mining) and is a Member of the Australian Institute of Geoscientists (MAIG). He holds a Bachelor of Applied Science in Geology from the University of Technology, Sydney, Australia, and a Master of Applied Science in Engineering, Hydrogeology and Environmental Geology from the University of New South Wales. He has extensive knowledge of brine deposits, lithium, uranium, phosphate, industrial minerals, gold and base metals. He has strong organisational skills as well as considerable expertise in the management of field programmes and safety policies. Mr Sawyer is the Qualified Person with overall responsibility for section 2.4 and 12.

2.2 Independence Declaration

The relationship between RSC and Avenir Makatea and Chatham Rock is based on a purely professional association. This report was prepared in return for fees based on agreed commercial rates, and the payment of these fees is in no way contingent on the results of this report.

2.3 Sources of Information

The information in this report is based on data supplied by Avenir Makatea, in addition to data collected by the authors or data that was collected under the supervision of the authors. Original certificates and PDF data files from ALS chemical analyses were provided and a PDF drilling database was made available to RSC.

Information relating to how samples were collected and processed was supplied in the form of Standard Operating Procedures (SOP) and company reports.

Information relating to property ownership, property titles, legal and environmental matters was sourced from existing documentation supplied by Avenir Makatea.

While RSC has made every effort to verify the data used in this report, information from third-party sources was used on the assumption that the contents were reliable and accurate, and that information is referenced herein. The authors of those records were not necessarily QPs within the context of NI 43-101. Such information is referenced in this report, as it is used, and in section 27.

2.4 Site Visit

Llyle Sawyer visited the project from 17th–31st August 2014, 23rd–28th April 2015, and 22nd–27th May 2015 to oversee the 2014 drill programme and the 2015 sample and mapping programme. Since the 2015 visits, no material change has occurred on the project. The QP has reviewed the reports compiled by Avenir Makatea, exploration data, and local press. Financial statements were not available to review; however, the QP is satisfied no material changes including no sampling or assaying for phosphate has occurred since the last site visit.

3 Reliance on Other Experts

The Qualified Person has not independently verified the legal status or title of the claims or exploration licences and has not investigated the legality of any of the underlying agreement(s) that may exist concerning the project area.

The Qualified Person has, in part, relied on information from Avenir Makatea, and reports, opinions and statements of other experts who are not qualified persons. Further details on additional sources of information are included in section 27.

In this ITR, the Qualified Person has relied on the opinion of an expert who is not a QP regarding the phosphate market conditions. René Sterk and Llyle Sawyer entirely relied upon and disclaim responsibility for the phosphate market conditions analysis described in section 19.1 of the report. The market analysis in section 19.1 were relied upon and are material to sections 1, 25 and 26. QP René Sterk used public research available online to verify current and historical phosphate prices as well as information provided by Mr Fourie regarding marketable phosphate parameters and market growth conditions.

4 Project Description and Location

4.1 Location

The Makatea Phosphate Project is located on the island of Makatea, in the Tuamotu Archipelago of French Polynesia. French Polynesia consists of five island groups: Society Islands, Marquesas Islands, Austral Islands, Gambier Islands and the Tuamotu Archipelago (Figure 1). The Tuamotu Archipelago is the largest chain of atolls in French Polynesia with 75 atolls scattered across nearly 1,500 km. Makatea is located at the northwest end of the chain. Makatea Island is located ~240 km northeast of Tahiti, the most populous island in French Polynesia (Figure 2). The Makatea Phosphate Project lies over almost half of Makatea, along the length of the northeast coast (Figure 3). The project covers an area of 1,036 ha (10.36 km^2).

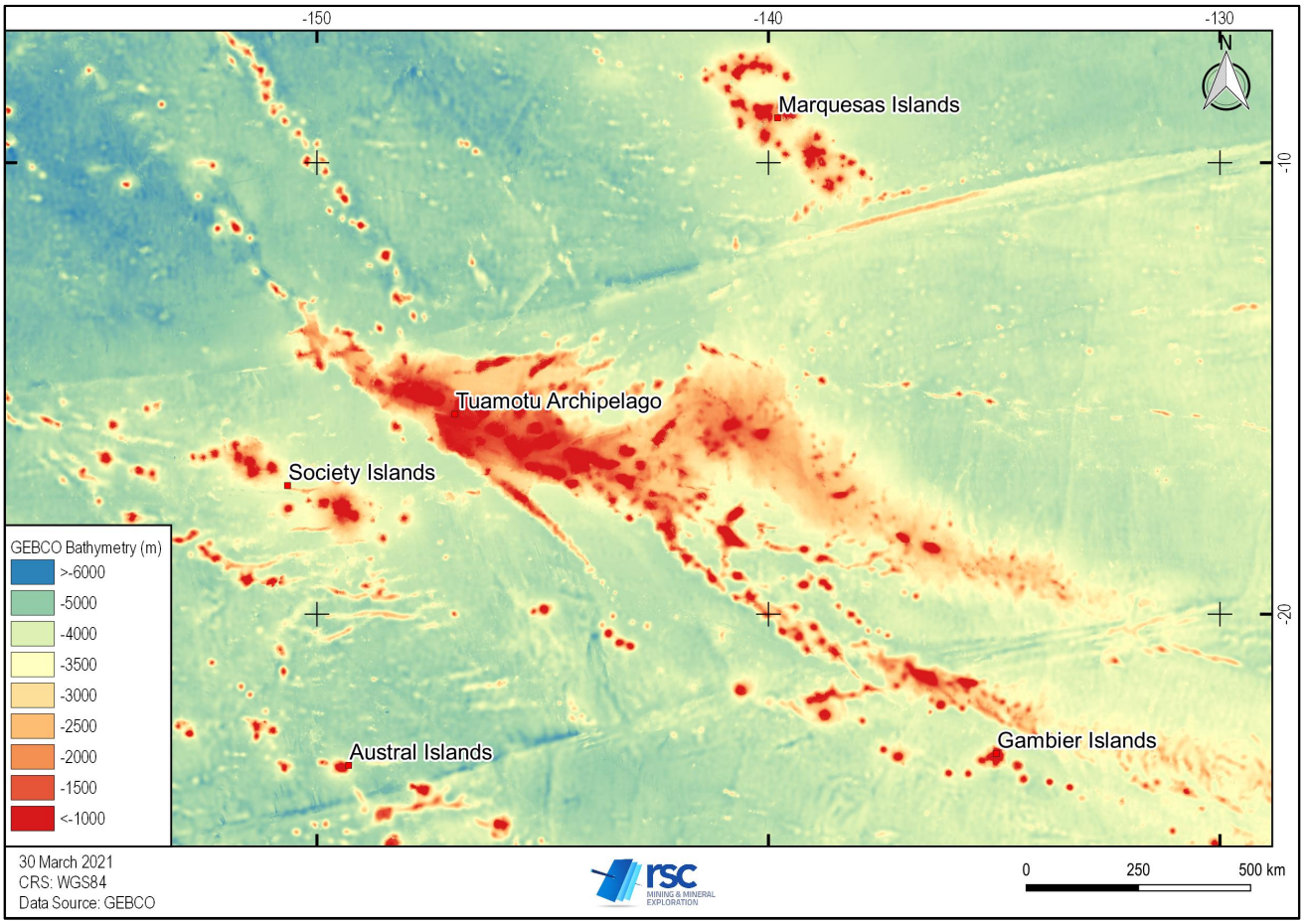

Figure 1: The island groups of French Polynesia.

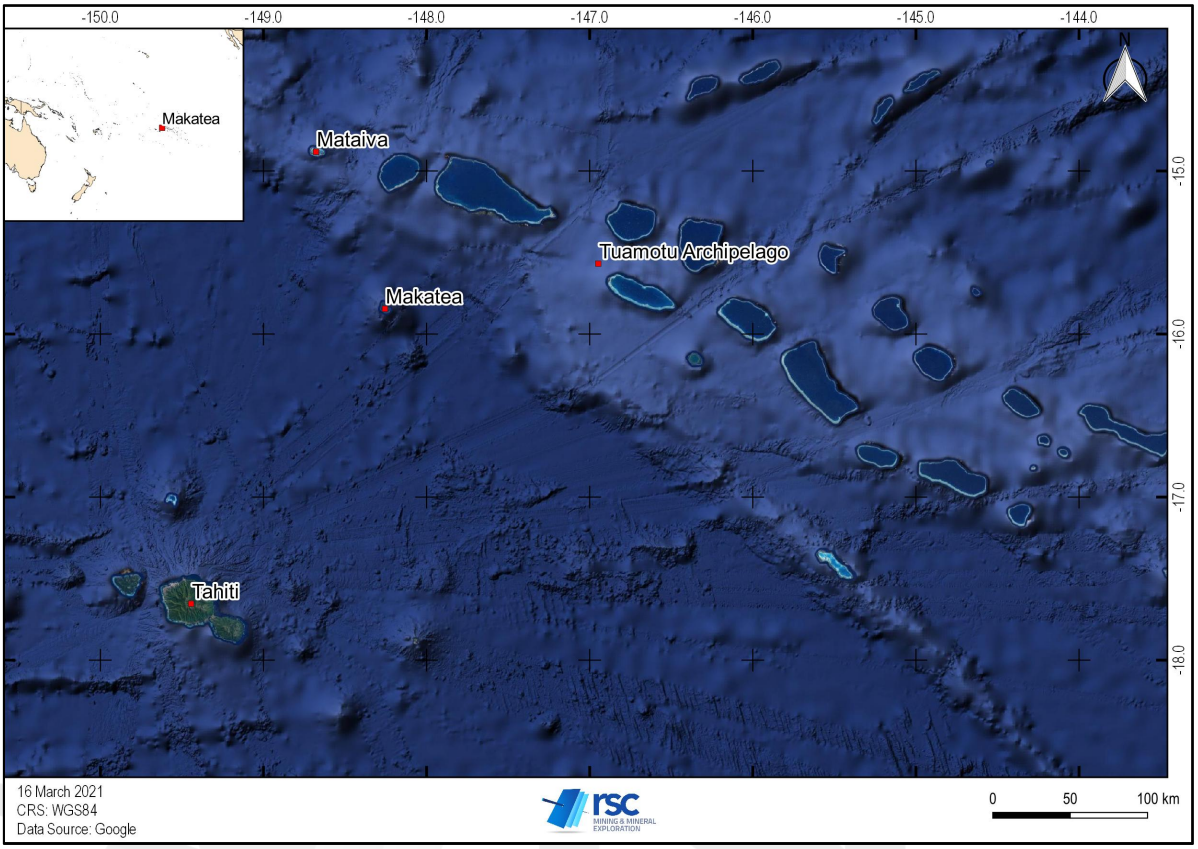

Figure 2: Location of Makatea Island.

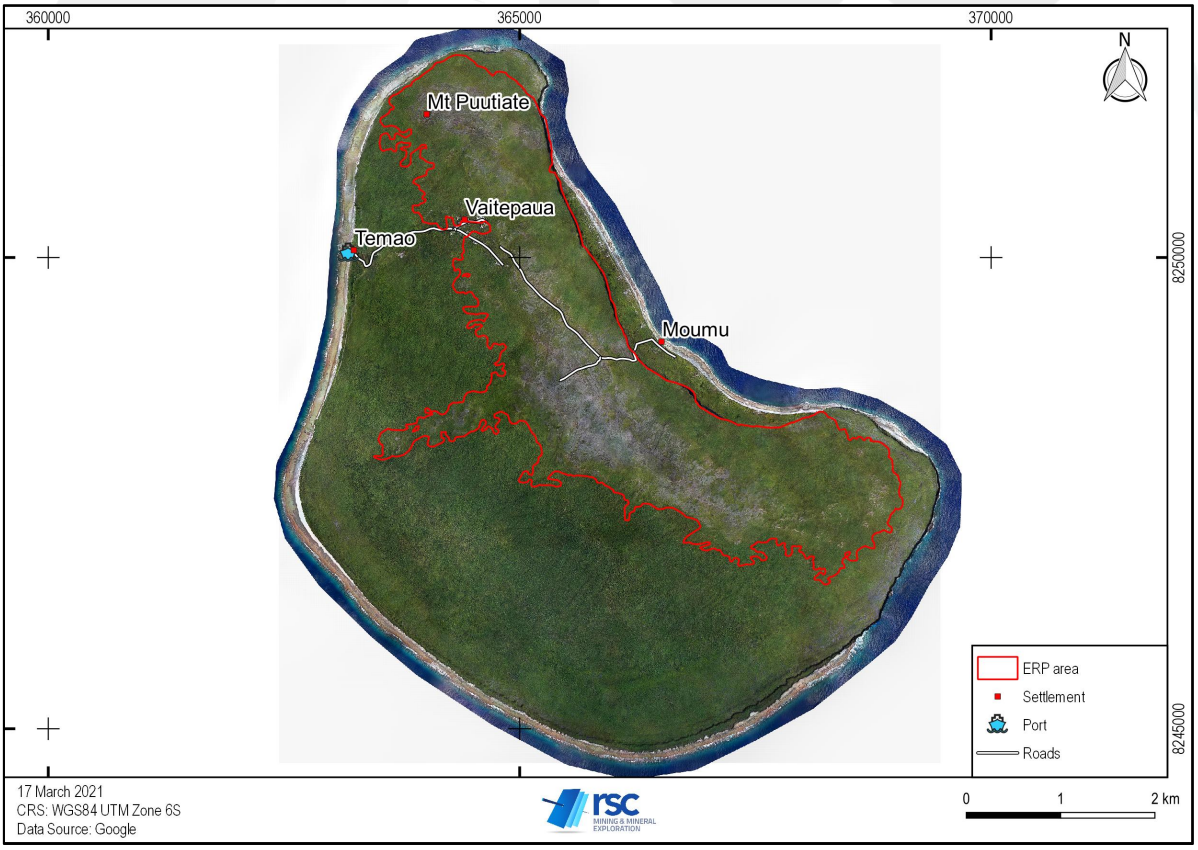

Figure 3: Makatea Island, showing the location of the ERP.

4.2 Mineral Tenure

On 28 January 2014, SAS Avenir Makatea (SASAM) was granted an exploration research permit (ERP) (Table 1). SASAM is a wholly owned subsidiary of Avenir Makatea Pty Ltd. The permit was originally granted to explore for phosphate within selected areas of the old mining area; however, in July 2014, the ERP was extended to cover the entire old mining area (Figure 3). The ERP was granted for a term of three years. The ERP gave SASAM the exclusive right to apply for a mining concession. In July 2016, SASAM applied for a mining concession over the previously mined area. This application is still being processed by the Council of Ministers. The pending decision on the application has been delayed due to the revision of the Mining Code. The ERP was due to expire in 2017; however, as outlined in Article 13 of Order No.789 of the Mining Code (1986) and superseded by Article LP 1220-5 of the Mining Code (2020), the validity of the permit is extended until a decision on the application has been made.

Table 1: Status of the mineral permit that comprises the project.

Permit	Ownership	Commodity	Date granted	Expiry date	Size (km^2)
Exploration Research Permit	100% SAS Avenir Makatea	Phosphate	28 January 2014	28 January 2017[1]	10.36

[1]The permit is still valid as per Article LP 1220-5 of the Mining Code (2020), as SASAM is waiting for a decision on their application for a mining concession.

The shareholders of Avenir Makatea entered into a share purchase agreement with Chatham Rock dated 28 April 2021 pursuant to which Chatham Rock, an arm's length party to Avenir Makatea, agreed to purchase all of the issued and outstanding shares of Avenir Makatea in exchange for 17,857,738 common shares of the Issuer, having a total deemed value of CAD1,455,000 (AUD1,500,000). Closing of this transaction is subject to various conditions precedent, including the approval of TSX Venture Exchange. Upon closing of this transaction, Chatham Rock would then hold Makatea Phosphate Project through Avenir Makatea as its wholly-owned subsidiary.

4.3 Surface Rights

In 2020, French Polynesia adopted a new mining code. Under this new code, the Council of Ministers issues mining titles (exploration permits and mining concessions) and research permits. All applications are subject to public consultation and concessions can only be issued after the completion of an environmental impact assessment. Permits and concessions can be granted as either exclusive or non-exclusive. SASAM holds an exclusive permit, which means they hold the exclusive right to undertake the research work for their concessional substance(s) (i.e. phosphate). Research permits are granted for a term of five years but can be extended twice for a maximum of three years. If an exclusive research permit expires before the final decision has been made on a concession application submitted by its holder, the validity of the permit is extended as of right, without formality, until a decision on the concession has been made. A concession cannot exceed 50 years.

4.4 Royalties and Encumbrances

Currently, the ERP is not subject to any royalties. However, if the project were to advance to a mining concession, a royalty would be charged on the mining extractions. The amount or percentage of tax that would be charged is unknown to RSC at the time of writing.

4.5 Environmental Liabilities

Any minerals extraction would have to comply with the French Polynesian Environment Code. The mine site would also need to be restored once the mining operation ceases. Any water used on site would need to be treated before being discharged.

RSC is unaware of any environmental liabilities to which the Makatea Phosphate project is currently subject to.

4.6 Permits

SASAM has been granted an exclusive right to engage in exploration operations within the ERP. This agreement has been issued by the Council of Ministers. Based on its review of the Mining Code and limited documentation provided by SASAM, RSC cannot comment on any risks that may affect access, title, or the ability to perform work within the ERP.

5 Accessibility, Climate, Local Resources, Infrastructure and Physiography

5.1 Accessibility

Makatea Island is remote, ~240 km northeast of Tahiti, and access is via boat or helicopter. There is no airstrip on the island, but there is a recognised cleared area for medevac helicopter landings. Helicopters can land and take off provided sufficient fuel has been delivered for the return trip by the monthly supply vessel. There is one unsealed road that links the port, the abandoned old mining town, Vaitepaua, and settlement Moumu (Figure 3; Figure 4). The rest of the island and access to parts of the ERP is on foot via a few well-kept and some overgrown paths. Half of the island is covered by primary forestry; however, a large portion of the ERP area was largely cleared of vegetation during the previous mining activity. As the old mining area was not rehabilitated after mining production ceased in 1966, the terrain is very uneven and highly treacherous with numerous deep karst holes and surface holes dug during the excavation of phosphate (Figure 4).

RSC notes that a high level of care must be used when moving around the phosphate deposit on Makatea and any future exploration activities must consider this for planning and budgeting.

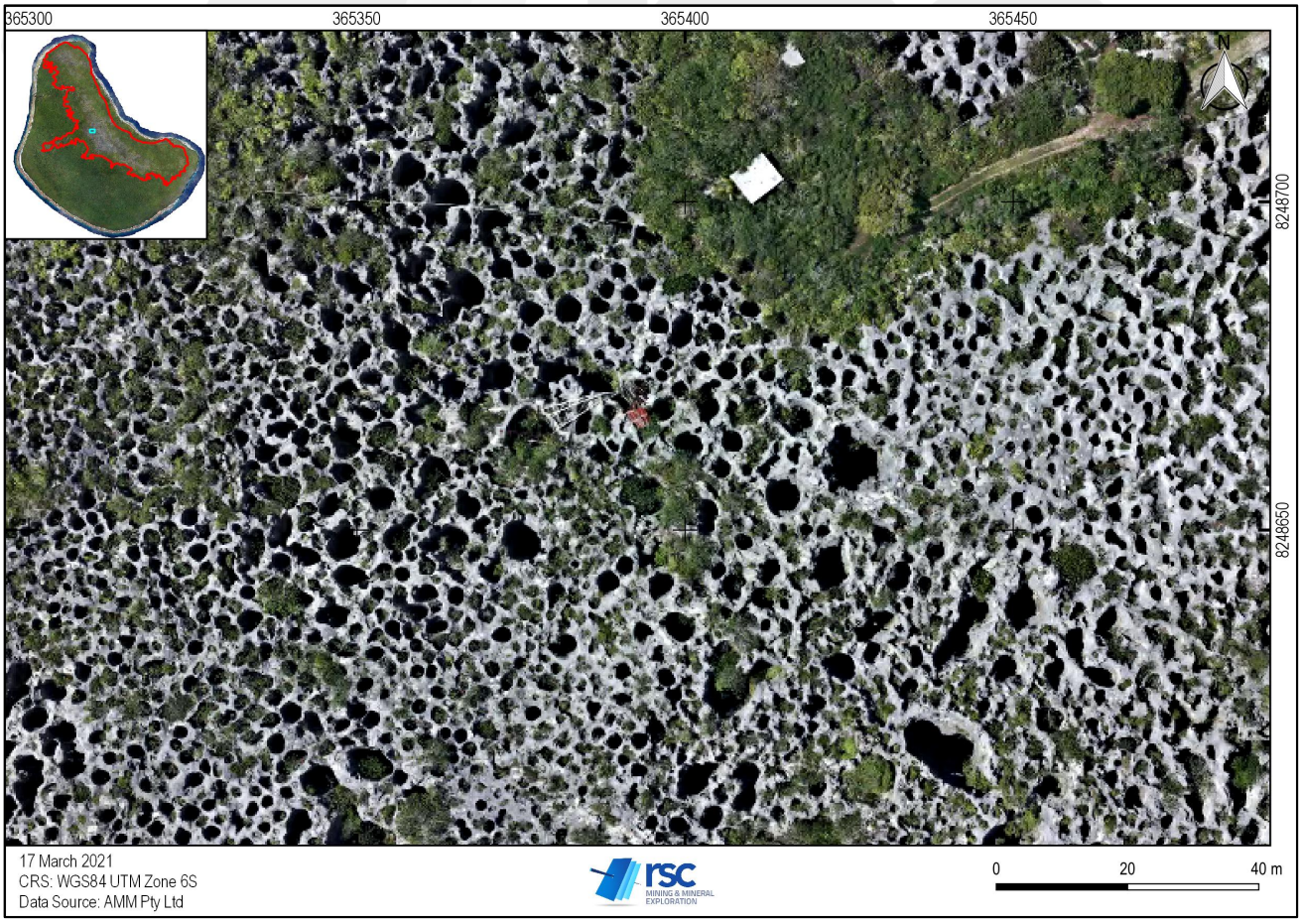

Figure 4: Honeycomb appearance on the surface of Makatea Island due to mined limestone karsts. Unsealed road is visible in the north-east corner of the map.

5.2 Climate

The climate of Makatea is tropical; Af on the Köppen-Geiger classification. The climate is influenced by the Southern Oscillation, where there is an inverse relationship between surface air pressure above Darwin, Australia, and Tahiti, French Polynesia (NIWA, 2021) affecting the trade winds. The air temperature of Tahiti varies from 21–31°C and the island receives an average of 1,715 mm of rainfall per year (Table 2). The average rainfall for Makatea is unknown; however, the Tuamotu Archipelago receives from 1,000–1,900 mm of rainfall annually (Brown, 2011). The seasonal variation may be >50%. The Tuamotu Archipelago generally receives less rainfall than the Society Islands (including Tahiti) due to their flat geomorphology. This is because mountains can enhance rain-cloud development (Climate to Travel, 2021). The Tuamotu Archipelago does not lie within the cyclone high-frequency area (Brown, 2011).

The climate at Makatea is unlikely to restrict exploration activities and activities can be conducted throughout the year. However, infrequent cyclones or storms may occur in the region which could restrict exploration activities.

Table 2: Monthly weather averages for Papeete, Tahiti.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Average Temperature (°C)	26.9	27	27.2	27	26.1	25.1	24.6	24.6	24.8	25.5	26	26.5
Minimum Temperature (°C)	23.7	23.8	23.9	23.7	22.9	21.7	21.4	21.3	21.6	22.2	22.9	23.4
Maximum Temperature (°C)	30.1	30.2	30.6	30.3	29.4	28.5	27.8	27.9	28.1	28.8	29.2	29.6
Rainfall (mm)	314	226	186	126	101	63	59	50	52	91	152	295

Source: https://en.climate-data.org/europe/france/papeete-tahiti/papeete-tahiti-3180/

5.3 Physiography

Makatea is a raised coral atoll. The island is 7.0 km by 4.5 km and is approximately semi-circle in shape. The island rises steeply out of the ocean, with vertical cliffs up to 80 m high. The maximum elevation is Mt Puutiare (111 m) at the northern end of the island (Figure 5). The interior of the island is predominantly a flat plateau. However, approximately half of the interior of the island exhibits karstic topographical surfaces giving the surface a honeycomb appearance; this has been intensified by the large number of hand-excavated holes left by the historical mining operation (Figure 4).

Figure 5: Topographic map of Makatea Island.

5.4 Local Resources and Infrastructure

Makatea Island was once home to over 3,000 people during the peak of historical phosphate mining. Since mining ceased in 1966, the housing, water supply system, port infrastructure, rail infrastructure and any mining equipment left behind have been in ruin (Figure 6). New infrastructure would be required for any new mining operation. Further studies will be required to see if the new infrastructure can be accommodated.

There is currently sufficient infrastructure to support the small population that varies from 30–60 people. There is a small harbour that can accommodate small fishing boats. Goods and consumables are supplied by a monthly vessel from Papeete. There is no airstrip, but helicopters can land and take off provided sufficient fuel has been delivered for the return trip by the monthly supply vessel. The port, village and beach are linked by one unsealed road.

There is a centralised solar power system that provides reticulated power to the village. If necessary, the power system can be supplemented by diesel-powered generators. The island has good telephone service with limited internet. Freshwater can be found in grottos ~60 m below the surface. Residents of Makatea collect rainwater from their roofs for domestic consumption. Historical water pumping rates from the grottos were sufficient to support a population of 3,000 on the island (pers. comm. C. Randal, 2021). An engineering study conducted by Egis estimate a daily consumption of approximately

540 m^2 would be required for mineral extraction activities and to support domestic consumption by mine employees (Egis, 2017).

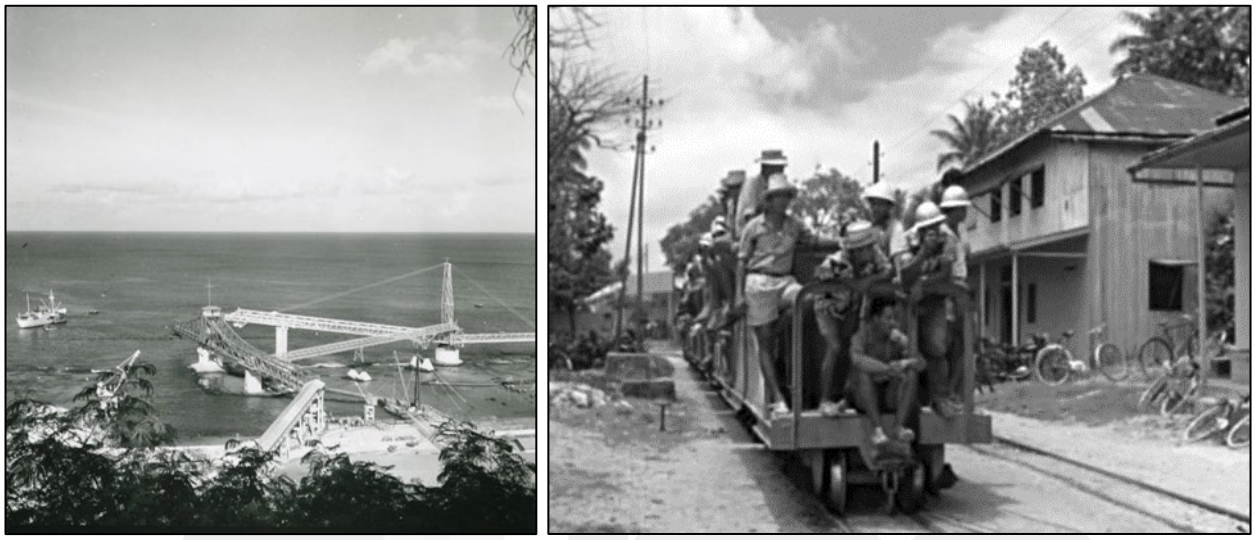

Figure 6: Photographs of old mining infrastructure including the port (left) and old rail network (right) that was used to transport raw ore to the drying and storage facilities. The port and rail infrastructure are now in ruins. Photographs from USC Libraries (2020) and Tahiti Heritage (2016).

6 History

6.1 Mining Industry in French Polynesia and the South Pacific

French Polynesia does not have an extensive mining history. Only one mining concession has been granted to Compagnie Française des Phosphates d'Océanie (French Company of Phosphates of Oceania; CFPO) to mine phosphate on Makatea Island. Phosphate was first discovered at Makatea during the mid to late 1800s by Captain Bonnet (Tahiti Heritage, 2016; Avenir Makatea, 2018); however, it was not until the 20th Century that exploitation of the resource began. In 1976, phosphate was also discovered at Mataiva Atoll, at the bottom of small basins within the lagoon.

Elsewhere in the Pacific, phosphate mining has occurred in Nauru and Banaba/Ocean Island, in the Kiribati Archipelago (Figure 7), extracting ~40 Mt and ~22 Mt of phosphate, respectively (Dupon, 1989; Pardon, 2020).

French Polynesia also hosts rare earth elements-enriched seafloor sediment that may be of supergene origin on the volcanic island Taha'a (Melleton et al., 2014) and polymetallic crusts rich in cobalt on the Tuamotu Plateau (Le Meur et al., 2018).

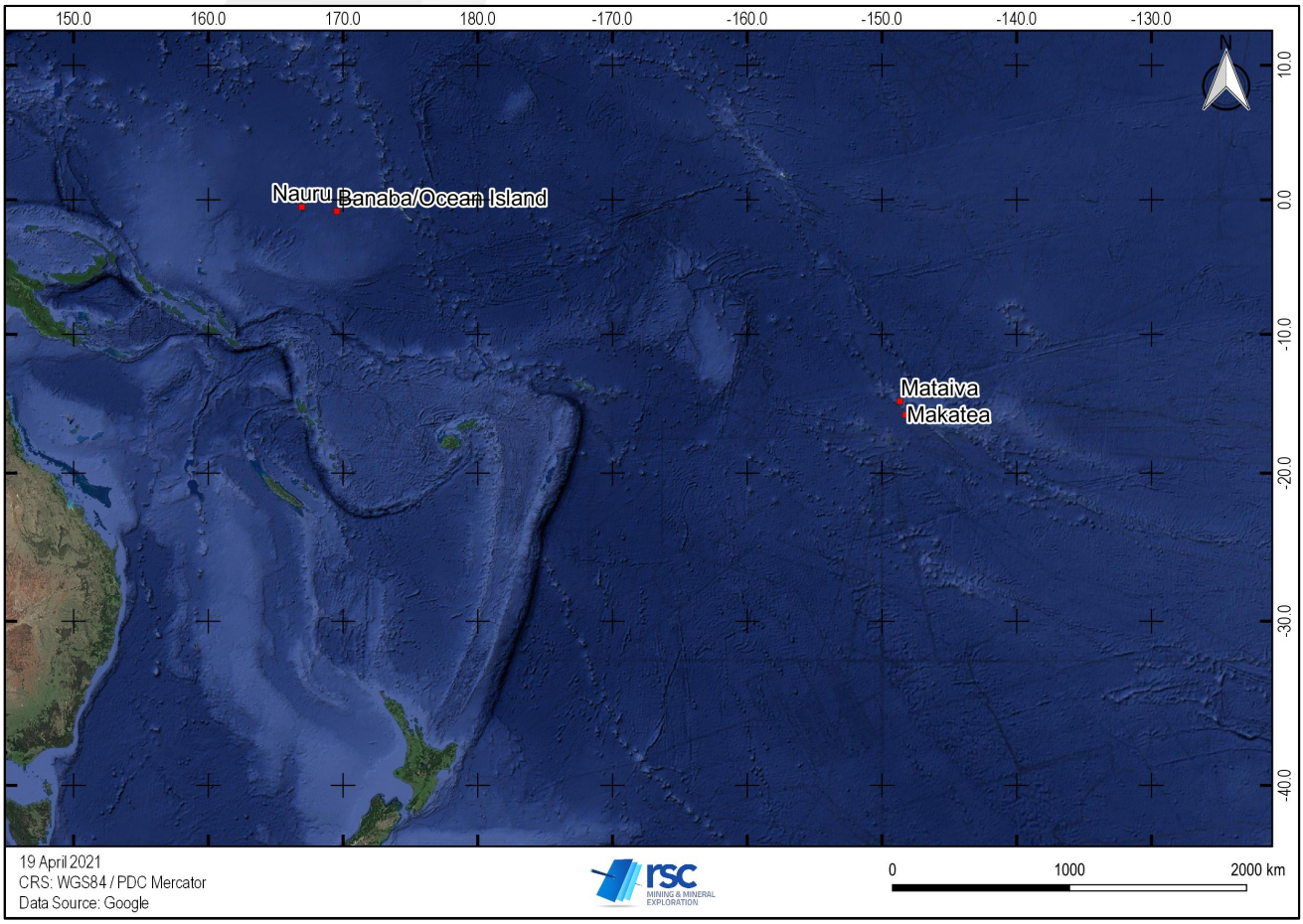

Figure 7: Location of other phosphate deposits in the South Pacific.

6.1.1 Exploration at Mataiva Atoll

Exploration at Mataiva began in the 1980s by a New Caledonian company in partnership with an Australian company. The names of these companies are unknown (Magnan & Duvat, 2015; Magnan, 2018); however, the United States Geological Survey (USGS) reports that Australmin was the company exploring Mataiva (Orris & Chernoff, 2002). Exploration included the collection of high-resolution, shallow penetration seismic reflection using a 3.5 kHz transducer mounted on a lightweight boat. The boat equipped with seismic equipment was able to cross shallow passes and coral shoals within the lagoon (Rossfelder, 1990). Drilling was conducted using a portable rotary JKS-Winkie that was fixed to an inflatable river boat. More than 700 drillholes were completed over the exploration period (Rossfelder, 1990). Dredging tests were also conducted, collecting approximately 6,500 m^3 of phosphate. Some of the phosphate collected was sent to Papeete for metallurgical testing and to New Zealand for superphosphate manufacture trials. Phosphate was intercepted within the basin structures of the Mataiva lagoon and was estimated to be 2.6 m thick, with an average grade of 38% P_2O_5 (Rossfelder, 1990). Historical resource estimates suggest there are ~15–18 Mt of phosphate at Mataiva (Rossfelder, 1990; Magnan, 2018). Although the company wanted to mine the resource, opposition by the inhabitants of Mataiva stopped the project from moving forward (Magnan, 2018).

6.2 Mining at Makatea

In 1908, Compagnie Française des Phosphates d'Océanie (French Company of Phosphates of Oceania; CFPO) was formed by Etienne Touzé, and in 1917 it obtained a mining concession covering the entire island (Tahiti Heritage, 2016). It is unknown if CFPO performed any exploration before applying for a mining concession.

Mining was carried out using non-mechanical equipment such as shovels, buckets, and wheelbarrows. Conveyor belts and a train were used to transport the phosphate sands to the horizontal kiln drier and storage facilities before the phosphate sands were loaded onto ships at the port (Tahiti Heritage, 2016). Mining was completed in teams or pairs, often grouped by their nationality or island affinity (Tahiti Heritage, 2016). A pair of workers were only paid once they had shovelled and loaded 41 wheelbarrows of phosphate sand each day (Avenir Makatea, 2020). Each wheelbarrow could hold ~100 kg of sand; therefore, one pair of workers would extract ~4 t of phosphate sand a day. Mining by CFPO only targeted phosphate sands; no bedded phosphate was mined.

Mining ceased in 1966, due to the expiration of the mining concession. At that time, the phosphate price was also low, the government had increased taxes on CFPO, and CFPO was in financial difficulty (Avenir Makatea, 2020).

6.2.1 Historical Mineral Resource Estimates

During the period of mining operation by CFPO, no historical resource estimates for phosphate were provided or found in the public domain.

6.2.2 Production

In 1911, CFPO mined 251,000 t (Tahiti Heritage, 2016) and in 1964, CFPO recorded a record production of 440,000 t mined and shipped (Avenir Makatea, 2020). Historical descriptions indicate a total of 11 Mt of phosphate sands were mined at Makatea. Phosphate was exported to Japan (through Mitsui Busan), Australia, and New Zealand.

6.3 Exploration by BRGM

During the 1980s, the Bureau of Geological and Mining Research (BRGM) explored Makatea Island (Avenir Makatea, 2020). No details or data on the exploration were provided or could be found in the public domain by RSC.

7 Geological Setting and Mineralisation

7.1 Regional Geology

French Polynesia is made up of five island groups: Society Islands, Marquesas Islands, Austral Islands, Gambier Islands and the Tuamotu Archipelago (Figure 1). These island groups are subparallel and strike nearly perpendicular to the East Pacific Rise. The Society, Marquesas, Austral and Gambier island chains are thought to have formed by hotspot magmatism (Duncan & McDougall, 1974; Grevemeyer et al., 2001; Bonneville et al., 2002; Patriat et al., 2002; Neall & Trewick, 2008). Unlike the Society, Marquesas, Austral and Gambier Islands, which rise ~4,000 m above the seafloor, the Tuamotu Archipelago consists of a large, relatively shallow plateau that does not exceed ~2,000 m depth (Figure 1, Patriat et al., 2002). Radiometric dating suggests the Tuamotu Archipelago is also older (50–70 Ma) than the other island chains of French Polynesia (Duncan & McDougall, 1974; Schlanger et al., 1984; Montaggioni, 1985; Okal & Cazenave, 1985; Dupuy et al., 1993; Patriat et al., 2002). The massive, submerged ridge and lack of high volcanic islands (the Tuamotu Archipelago consists only of atolls) is also a point of difference from the neighbouring island groups. The Tuamotu Archipelago is thought to have formed at or near the spreading centre of the East Pacific Rise (Buigues, 1997; Patriat et al., 2002).

Northwestern atolls of the Tuamotu Archipelago have been subjected to three uplift phases. From 18–15 Ma, the northwestern atolls transited in the vicinity of the active Hereretue hotspot swell (Brousse, 1985). Makatea Island was subject to isostatic rebound due to asthenospheric loading related to the active Hereretue hotspot, resulting in the uplift of a few tens of metres (Montaggioni & Camoin, 1997). Uplift was followed by a period of submergence during the late Miocene–early Pliocene. The second phase of uplift occurred from ~6–4 Ma as the northwest atolls moved over the flanks of the Society hotspot, resulting in uplift due to asthenospheric buoyancy (Montaggioni & Camoin, 1997). At the end of the Pliocene, Makatea reached a maximum height of ~100 m above sea level. The third phase of uplift occurred at the beginning of the Pleistocene. Lithospheric flexure, generated by the loading of Tahiti and Meheti'a volcanoes, resulted in the rebound and uplift of Makatea and nearby atolls, including Anaa Atoll (McNutt, 1978; Pirazzoli & Montaggioni, 1988; Montaggioni & Camoin, 1997; Avenir Makatea, 2020).

Nearby atoll, Mataiva, has also experienced a similar uplift and submergence history to Makatea. However, unlike Makatea, which is presently raised above sea level, Mataiva is a typical atoll with a lagoon. Previously, the bedrock of the lagoon was subaerial and experienced karstic weathering and dolomitization (Rossfelder, 1990). Mataiva also hosts a significant submerged phosphate deposit. The source of the phosphate deposit is thought to be avian, but a volcanic, oceanic or bacterial source cannot be ruled out (Rossfelder, 1990).

7.2 Local Geology

Makatea Island is composed of four major stratigraphic units (Montaggioni et al., 1985; Montaggioni & Camoin, 1997; Brown, 2011). A description and definition of the different types of carbonate units are in APPENDIX A:.

- Early Miocene series: ~10 m thick, planar-bedded strata of strongly dolomitised bafflestone. The outcrop is only visible on the western coast. It is likely the bafflestone was deposited in a shallowly submerged, high–medium

energy platform. A 60-m thick carbonate unit overlies the basal bafflestone. This carbonate unit makes up the bulk of the island. Concentrically distributed, the core of the carbonate unit consists of molluscan-echinoidal-foraminiferal wackestone and mudstone, which grades to foraminiferal packstone and wackestone, coral-molluscan grainstone, packstone and wackestone to coral-algal boundstone at the fringes of the deposit (Figure 8). All of these carbonate units are locally dolomitised.

- Miocene-Pliocene series: The Miocene-Pliocene series consists of phosphate deposits. The phosphate deposits are heterogeneous and display evidence of numerous episodes of precipitation, dissolution and internal sedimentation. The phosphate rocks unconformably overlie the Miocene karst-rich carbonate.
- Pleistocene unit: Two generations of reef terraces, the older terrace dated at 200 ka and the younger terrace dated at 140–100 ka. The terraces consist of aragonite to low-Mg calcite, coral framestone and algal bindstone, associated with foraminiferal-algal grainstone and packstone. The older terraces reach a maximum of 20 m above sea level on the eastern and southern coastal areas, whereas the younger terrace is 5–8 m above sea level and occurs as cliff-veneering apron reefs and well-developed fringing reefs along all the shores.
- Holocene unit: The youngest unit corresponds to the exposed peripheral fringing reef. The unit is ~0.5 m thick and lies on the erosional surface of the Pleistocene unit.

The basement of the early Miocene reef platform is thought to be composed of a Palaeocene-Oligocene carbonate bank (Montaggioni & Camoin, 1997); however, other possibilities such as volcanic (basalt) seamount have been suggested (Avenir Makatea, 2020). The Miocene platform has concentrically zoned depositional environments with a central, very shallow area containing biogenic sands and muds, which was once a lagoon, and outer coral-algal rims (Figure 8) (Montaggioni & Camoin, 1997). Infilling sediments resulted in the platform growing upwards, keeping pace with sea-level rise. The final stages of platform formation were the infilling of the backreef area. Post-depositional dolomite alteration occurred locally over parts of the Makatea reef platform. Dolomitisation is thought to be related to the fluctuating freshwater-saltwater interface, likely caused by eustatic sea-level changes (Montaggioni & Camoin, 1997). The isotopic composition of the dolomite suggests the dolomite formed in a seawater-dominant environment; however, a freshwater-seawater mixing zone cannot be ruled out (Hein et al., 1992; Montaggioni & Camoin, 1997). Relative sea-level decreased several tens of metres during the middle Miocene to expose the carbonate/dolomite. Carbonate dissolution by meteoric water caused karstic alteration of the carbonate/dolomite forming the characteristic topography of the island. At the same time, dolomitisation intensified as dolomitising fluids were able to penetrate the limestone core (Figure 9) (Montaggioni & Camoin, 1997).

During the late Miocene to early Pliocene, phosphate precipitation initiated and, as karstic weathering of the dolomite/carbonate intensified, the phosphate was redeposited into the karst cavities (section 7.3). The hard limestone/dolomite that has undergone karstic weathering is locally known as ‘feo’ in French Polynesia.

Makatea has undergone extension related to normal faulting. Three main fault orientations exist (Montaggioni et al., 1985; Montaggioni & Camoin, 1997).

- The predominant fault trend runs NE–SW and may cut the whole island.

- A WNW–ESE fault system divides the island into two morphologically different areas from Vaiau-Tamura (a large northern atoll-shaped block and a southern terraced block).
- A NNE–SSW fault system is found on the west coast.

Some of the faults or fracture zones on Makatea are filled with phosphate-bearing breccia (Sawyer, 2015b), indicating these structures were active during or after Miocene-Pliocene phosphate precipitation (Gerbier, 2015).

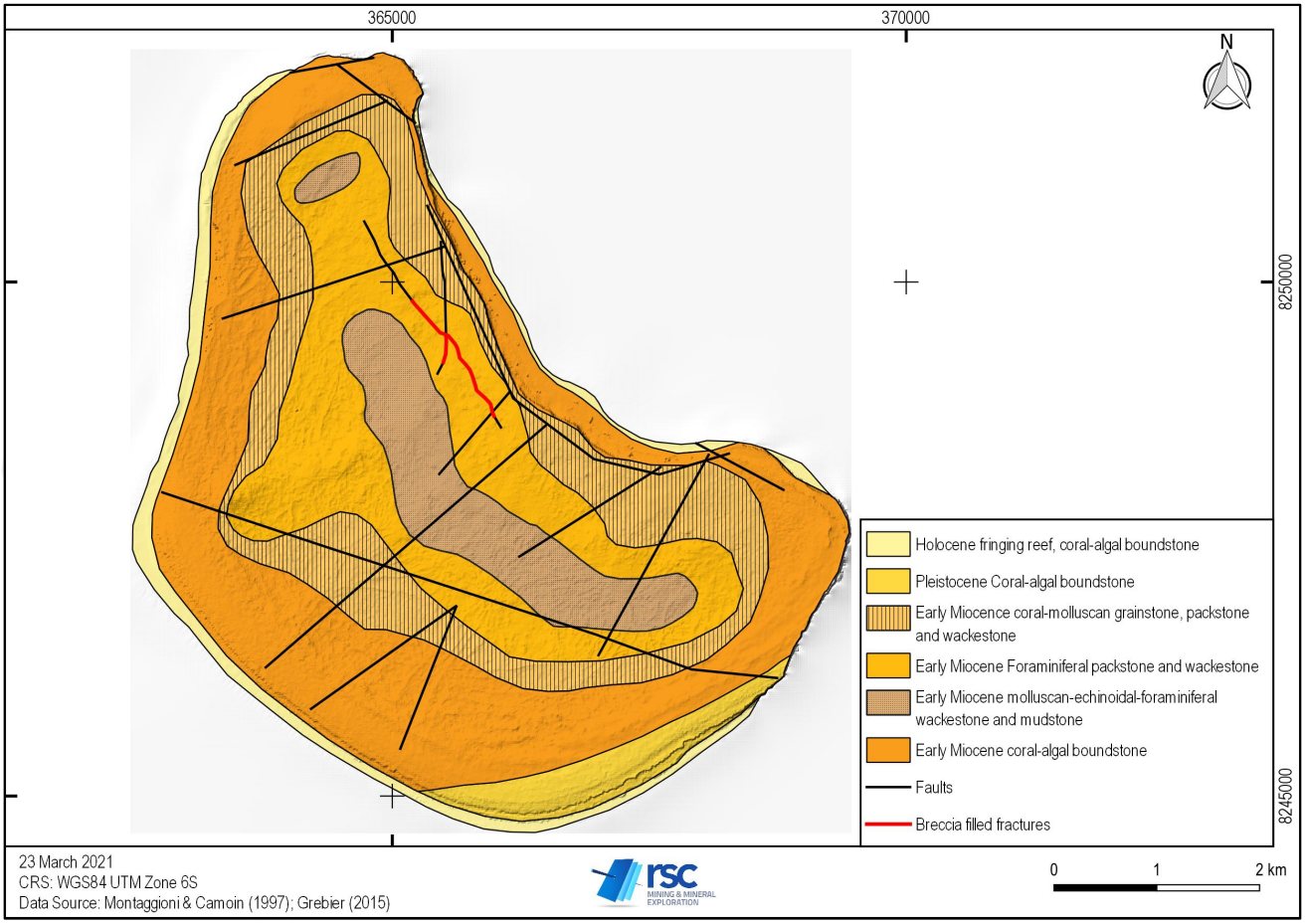

Figure 8: Geological map of Makatea. Modified after Mongtaggioni & Camoin (1997) and Grebier (2015).

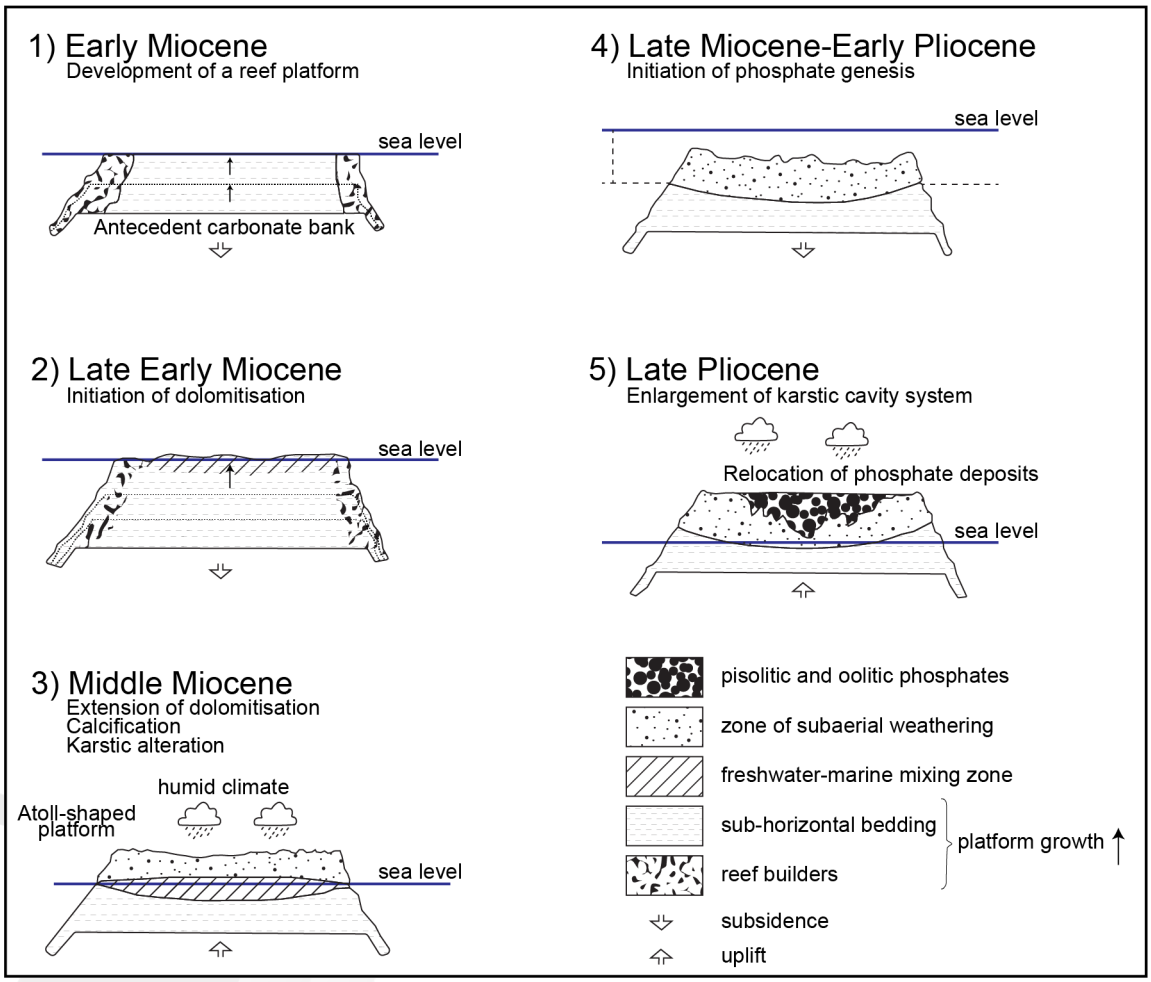

Figure 9: Conceptual evolutionary schematic of Makatea Island (Montaggioni & Camoin, 1997).

7.3 Mineralisation

Phosphorites are rocks with a phosphate (P_2O_5) concentration exceeding 18 wt.% and, in some cases, phosphorites can exceed 35 wt.% P_2O_5 (e.g. Lagamar Mine, Brazil; Scotts Mine, Canada; Glenn et al., 1994; Orris & Chernoff, 2002). Primary phosphate deposits form through the precipitation of carbonate fluorapatite (CFA) within marine sediments, at the sediment-water interface or during diagenesis. Reworking of the primary phosphate by bottom currents can form secondary granular phosphorites, such as conglomerates or sandstones. Precipitation of CFA, or adsorption of other phosphate minerals, may occur deeper in the sediment column; however, the rate of phosphate mineralisation at depth is typically slower than the rate of mineralisation/precipitation for other minerals (Glenn et al., 1994). Therefore, the precipitation of CFA at depth does not provide a large input into the phosphate budget.

At Makatea, the mechanism of phosphate mineralisation is debated, and multiple sources have been suggested. Possible sources include the reaction between guano and karstic limestone (Montaggioni, 1985), volcanic material (although this is less likely due to Makatea's isolation from the volcanic Society Islands which is predominantly basaltic with only minor pyroclastite (Montaggioni et al, 1985)), and equatorial upwelling of cold seawater, where the upwelling, P-rich seawater

precipitates CFA as the P solubility decreases due to a decrease in CO_2 pressure and increase in pH (Kazakov, 1939; Avenir Makatea, 2020). Additionally, microbial mats may have played a role in phosphate mineralisation, where sulphide-oxidising bacterial can precipitate apatite (Rougerie et al., 1997).

The phosphate deposit at Makatea Island is similar to other Pacific atolls (i.e. Mataiva Atoll) with the exception that Makatea is now uplifted ~70 m above sea level. The lagoon at Mataiva shows a basin-in-basin structure, where the phosphate has precipitated within the separate basins. Makatea Islands also has a basin-in-basin structure (Grebier, 2015); however, as the island has been uplifted and undergone intensive karstic alteration, the basin-in-basin structure is less obvious.

The phosphate occurs as several different units at Makatea (Figure 10; Brown, 2011), including:

- loose sand with phosphate nodules, pebbles and block;
- bedded, hard pisolitic phosphorites which underlie the barren limestone cap, often visible on the inside of the karst holes; and
- hard, light-brown, well-cemented, brecciated phosphate.

The phosphate is predominantly phosphate sand, which fills, or previously filled in the cases of the historical mining area, pits or holes formed by the karstic weathering. In places, the phosphate is hardened and interbedded with the overlying limestone/dolomite. The phosphate is discontinuous and appears as irregular-sized pockets (Figure 11).

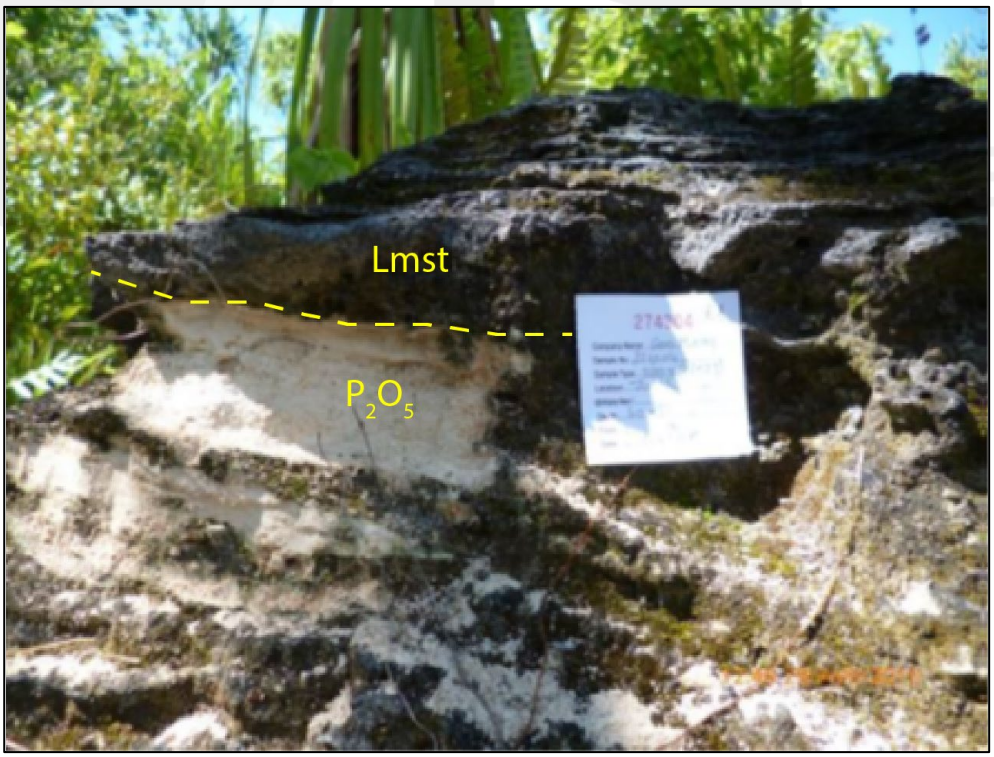

Figure 10: Photograph of bedded phosphate that lies beneath the hard capping limestone/dolomite, sample 4034, 364479 8249714 (WGS 84 6S; Avenir Makatea, 2020).

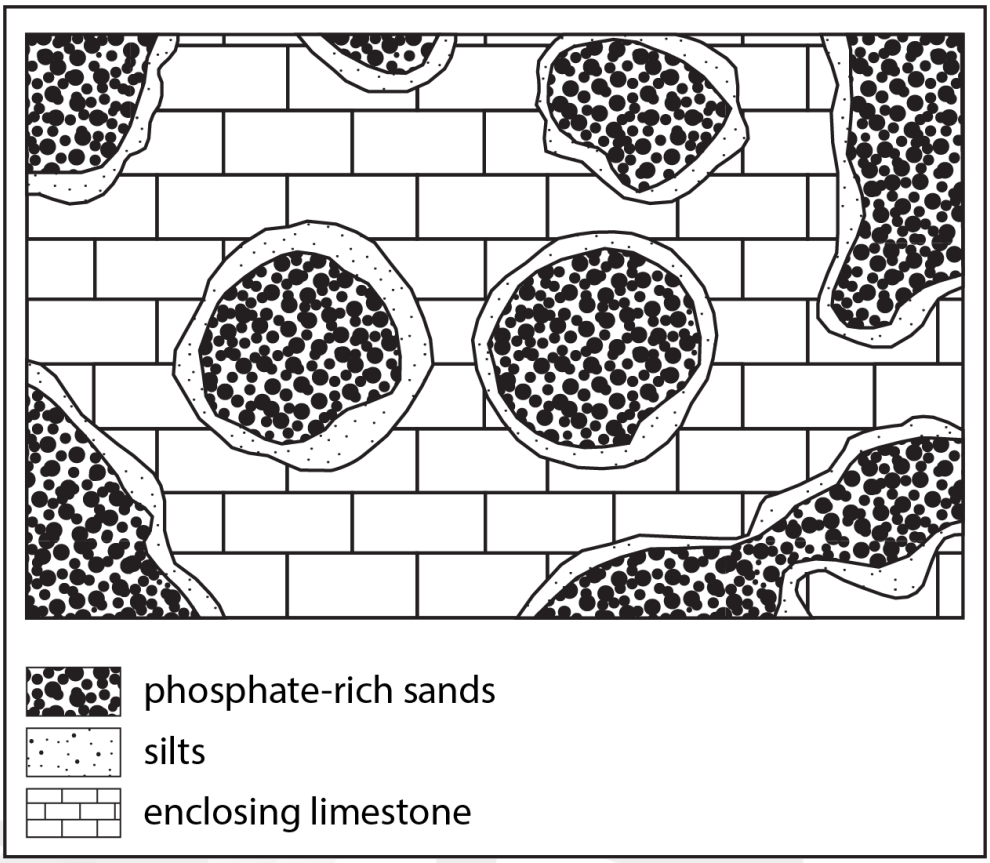

Figure 11: Schematic horizontal cross-section (~3 m deep) through the Makatea phosphate deposit. (Modified from Brown, 2011).

X-ray fluorescence analysis of phosphorite from Makatea reveals a strong, linear relationship between phosphate and fluorine (F) (Figure 12). The strong association between phosphate and fluorine indicates the main phosphate host mineral is fluorapatite ($Ca_5(PO_4)_3F$) and suggests the phosphorites formed in a seawater-salt-calcareous environment (Avenir Makatea, 2015). The median concentration of fluorine measured (section 11.1) in the phosphorites is 2.8 wt.%, which is indicative of phosphate deposition in a marine environment, rather than formation associated with guano (Rougerie & Wauthy, 1989).

The phosphorites on Makatea show rare original skeletal structures and isolated pockets of unaltered carbonate grains (Montaggioni, 1985). At Makatea, phosphate mineralisation can be subdivided into six microfacies (Montaggioni, 1985):

- phosphate oolitic grainstones;
- phosphate intraclast-bearing packstones;
- phosphate packstones composed of very large phosphatic intraclasts;
- bioclast-bearing packstones;
- bioclastic-oolitic grainstones; and
- phosphate caliches (APPENDIX A:).

Exploration work to date has not demonstrated significant geological continuity of the phosphate beds. Phosphate was precipitated in the bottom of karst holes and/or reworked during uplift and karst intensification (Figure 11). Isolated breccias and conglomerates, containing phosphate clasts found on Makatea, provide additional evidence of reworking and the formation of secondary phosphate rocks.

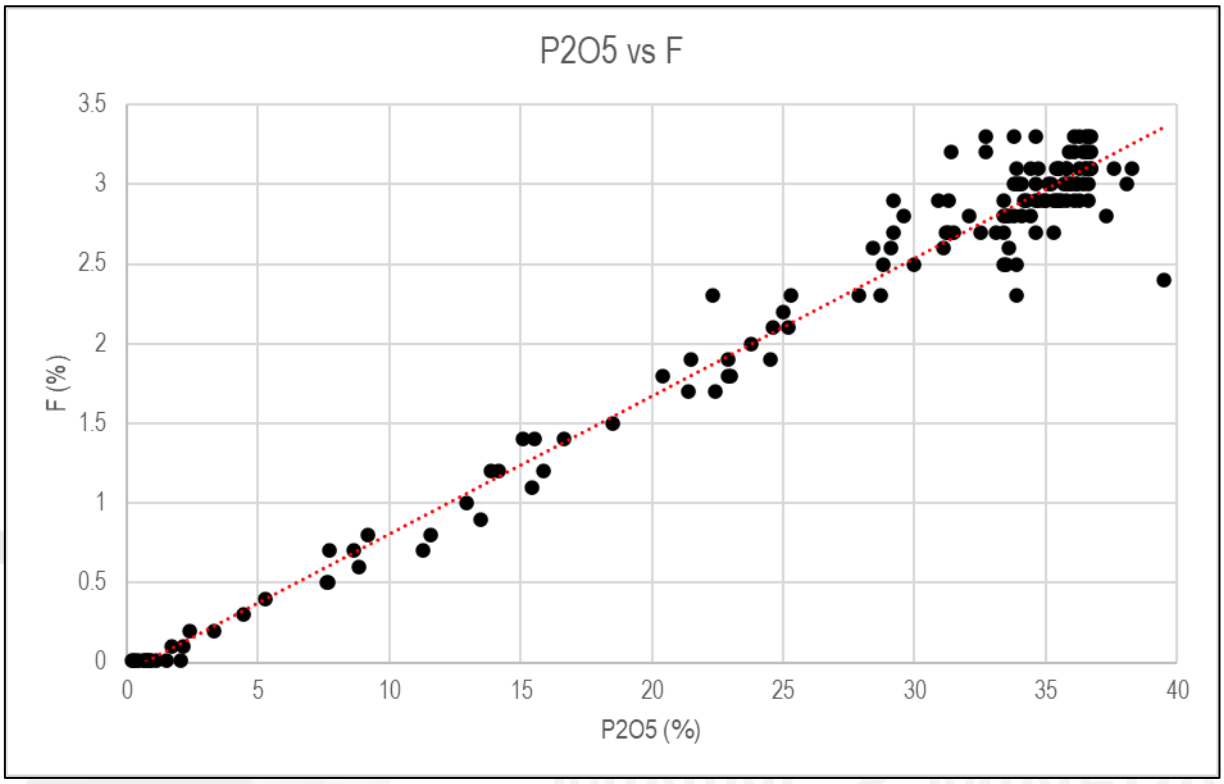

Figure 12: Relationship between phosphate and fluorine (Avenir Makatea, 2015).

8 Deposit Type

The processes that form phosphorites globally are debated and many different processes have been hypothesised. For example, seawater upwelling, microbial concentration, organic phosphate input, fishbone dissolution, redox pumping of phosphorus and concentration of phosphate in guano (Crosby & Bailey, 2012; Glenn et al., 2014). Phosphate mineralisation can occur in numerous settings: top of seamounts, continental margin, epeiric sea environments, and insular deposits on carbonate islands, atolls or within atoll lagoons (Figure 13; Glenn et al., 2014). The phosphate at Makatea Island is an example of insular phosphorites, where phosphate was precipitated within an atoll lagoon that has subsequently been uplifted. One possible mechanism for phosphate mineralisation at Makatea is the precipitation of carbonate fluorapatite (CFA) due to the endo-upwelling of cold seawater. As cold seawater rises, the partial pressure of CO_2 decreases, increasing the pH of the near-surface seawater, causing the solubility of CFA to decrease (Kazakov, 1939). Another mechanism that possibly occurred, alongside the upwelling of cold seawater, is the formation of cyanobacterial mats, known as 'kopara' in the Tuamotu Archipelago (Rougerie et al., 1997). Kopara can extend several metres thick, and the older layers are enriched in phosphorus resulting in the precipitation of phosphate minerals within the kopara mat (Rougerie et al., 1997).

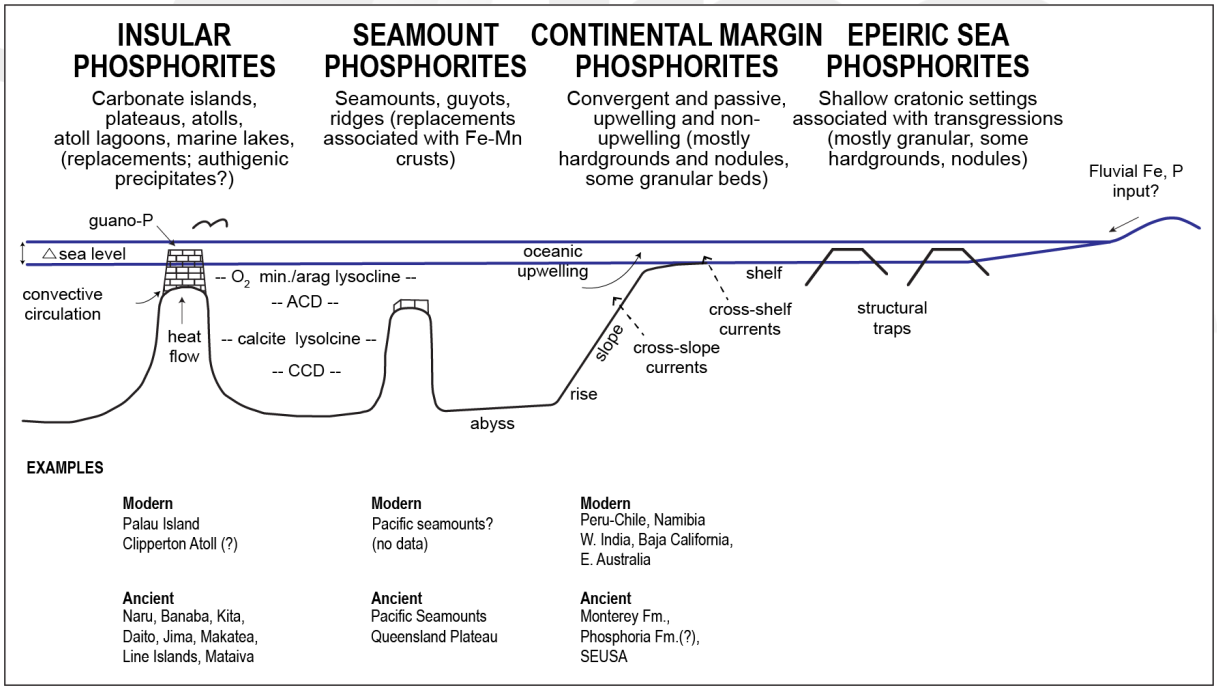

Figure 13: Four models of phosphorite formation. The Makatea Phosphate Project is an example of insular phosphorites (modified from Glenn et al., 1994).

9 Exploration

9.1 2010 Desktop Study

In 2010, Avenir Makatea commissioned a PhD student, Peter Newton, to undertake a three-month desktop literature search and scoping study on the phosphate resource on Makatea. The study did not estimate the quantity of phosphate remaining after mining but did suggest areas that were potentially not mined by CFPO, including identifying an area under the old mining village, Vaitepaua, and under the old railway tracks. The report also included the views and opinions of locals on secondary mining. Most of the locals were positive and optimistic that mining would be beneficial to their society. The results from this study were deemed positive by Avenir Makatea, who decided to progress with further exploration.

9.2 2011 Sampling & LIDAR

In early 2011, Avenir Makatea commissioned a geological report on Makatea Island (Brown, 2011) and in August 2011, an initial reconnaissance trip to Makatea resulted in the collection of rock samples of bedded phosphate, phosphate sand and conglomerates (Avenir Makatea, 2020). Samples were collected using a rock hammer and placed into labelled plastic, zip-lock sample bags. No documentation on the sampling method is available for this campaign. Photographs of some of the samples were taken by Avenir Makatea (Figure 14. A total of 63 rock samples were collected (Figure 15), including 54 outcrop samples and nine samples from ore bins that remained on the island from CFPO's operations. The samples were sent to ALS Geochemistry, Brisbane, Australia, and analysed for a suite of 10 oxides (section 11). The average P_2O_5 concentration is 10.1% with a maximum value of 37.9% (Table 5 and appendix B.1). Seventeen of the 63 samples are classified as phosphorite (i.e. the P_2O_5 concentration exceeds 18%), which includes eight samples collected from the ore bins. The remaining samples are limestone (up to 55.4% CaO) that have experienced various degrees of dolomitisation (up to 18.4% MgO; appendix B.1).

Figure 14: Photograph of sample MK056 collected during the 2011 exploration programme.

In November 2011, AAM Pty Limited conducted a Light Detection and Ranging (LiDAR) and aerial survey over the whole island of Makatea. This produced a 1-m resolution digital terrain model (DTM) of Makatea Island and captured a 0.25-m resolution aerial image of the entire island. Airborne laser scanning data were acquired using a fixed-wing aircraft over two days to be able to determine the ground surface over the old mining area on Makatea.

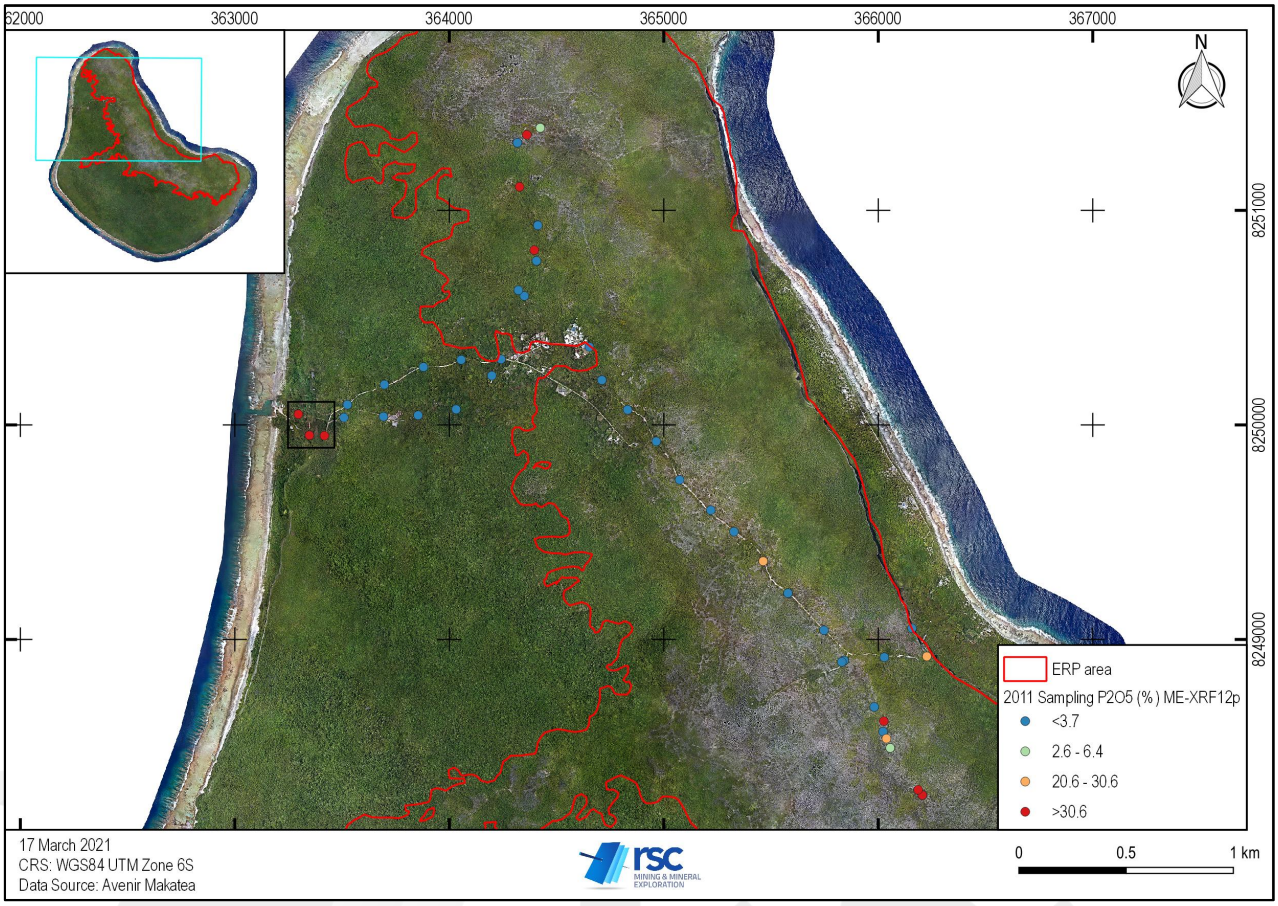

Figure 15: Location of the samples collected during the 2011 sampling programme. The western most samples (within the black box) are the samples collected from the ore bins.

9.3 2014 Drilling and Sampling

In 2014, SASAM completed a reconnaissance drill programme and collected 14 surface samples. The 14 surface samples consisted of a mixture of rock and soil samples and were collected from the near vicinity of the different drill sites. The method of collecting the surface samples is unknown. The location of the samples was recorded using a handheld JUNO GPS, which has a horizontal accuracy of ± 2–4 m. The surface samples were analysed by portable X-ray fluorescence (pXRF) in the field and sent to ALS Brisbane for laboratory analysis of P_2O_5 and other major oxides (section 11). All the samples returned high P_2O_5 concentration from 30.3–38.5% (Figure 16) with an average P_2O_5 concentration of 35.5% (Table 5). The laboratory assay results for the 2014 surface samples are reported in appendix B.2. All samples have a moderate to low Ca:P_2O_5 value, ranging from 1.4–1.7, with an average of 1.5. The samples have low concentrations with other major oxides, with a maximum of 0.8% Al_2O_3, 0.71% Fe_2O_3, 0.01% K_2O, 0.03% MnO_2, 0.22% Na_2O and 0.13% TiO_2.

During fieldwork, Sawyer (2014) noted the phosphate sand was discontinuous, and of variable thickness, but was typically thin, less than 0.5 m thick. The vertical and lateral extent of the phosphate sand and other thin, phosphate-bearing sandy–pebbly limestone capping units are unknown. The sandy–pebbly unit is visible at a number of the drill sites, indicating the unit was locally extensive before karst topography exhumation; however, the occurrences are now discontinuous.

Phosphatic siltstone clasts, or lens inclusions, and phosphatic sandstone boulder/pebble inclusions within the upper limestone unit were observed, suggesting a redistribution of phosphatic material by wave action or other mass weathering processes (Sawyer, 2014).

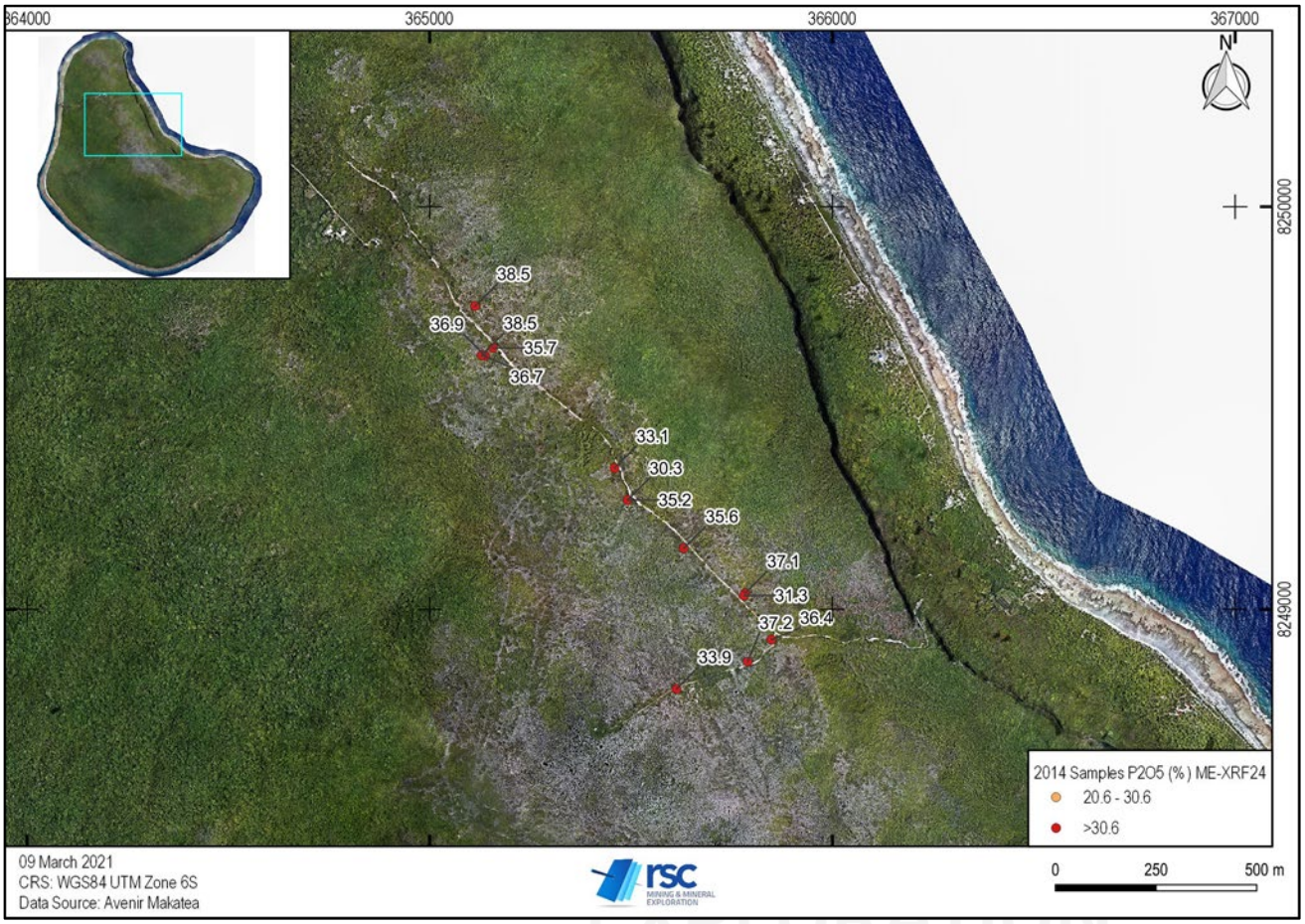

Figure 16: Location of the surface samples collected in 2014.

9.4 2015 Sampling and Mapping

Over April and May 2015, a second reconnaissance sampling programme was carried out. A total of 147 phosphate samples were collected (Figure 17). The surface samples (including samples of phosphate collected from within the karst holes or pits) were collected along a channel, where possible, so that the sample was collected in a standardised manner over a length of 20–30 cm across the site of interest. Samples were collected using a small garden trowel and ranged in weight from 0.15–0.5 kg. The trowel was brushed clean between samples to minimise contamination. The material collected was either stored in a plastic zip-lock sample bag or cloth sample bag (Sawyer, 2015b). Cloth bags were used to store sharp-edged samples e.g. rock-chips of breccia. Where possible, samples of limestone were also collected adjacent to the sampled phosphate layers. The location of the samples was recorded using a handheld JUNO GPS, which has a horizontal accuracy of ± 2–4 m. For each sample, a sample ticket was filled out with the sample ID, site ID, date and coordinates. The

ticket was placed inside the sample bag. The sample ID was also written on the outside of the sample bag. Sample ticket information was entered into a field electronic notebook and later into an Excel spreadsheet.

The location of the sample site was recorded and photographed (Figure 18). The particular layer sampled and one of the samples in the sample bags were also photographed. In some cases, a 360° video was captured of the sample site using a GoPro camera. Samples were returned and stored at the operational base on Makatea at the end of each day. There, samples were counted again, and if it was noted any samples were missing, these were located the following day.

Samples were analysed in the field by pXRF (section 11). After the samples had been analysed by pXRF, the samples were re-bagged in calico samples bags. These were batched into larger bags containing 25 samples and stowed in a trunk for transfer from the wharf via dingy to the waiting transport ship. Once onboard the transfer ship, the trunks were stowed in the goods area for the journey to Papeete. At Papeete, the trunks were unloaded and delivered to the PTPU office via courier. The samples were checked at the PTPU office and arrangements made for the samples to be sent to Brisbane for analysis.

Samples with >8% P_2O_5 were sent to ALS Brisbane, Australia for laboratory XRF analysis. The P_2O_5 concentration varies between 0.21–39.5% and 111 samples have a P_2O_5 concentration greater than 18%. The high P_2O_5 samples have an average Ca:P_2O_5 value of 1.4. The low P_2O_3-bearing samples have high Ca concentrations (up to 55.1%) and one sample has relatively high MgO (17.05%). The samples have low concentrations with other major oxides, with a maximum of 0.43% Al_2O_3, 0.32% Fe_2O_3, 0.01% K_2O, 0.02% MnO_2, 0.13% Na_2O, 0.05% SiO_2 and 0.06% TiO_2.

During the mapping of the sample sites, and from observations moving between sites, Sawyer (2015b) noted several occurrences of hard, upright limestone/feo ridges. The ridges dominate the eastern areas of Makatea, where they potentially form the edge of the lagoonal sediment fill and phosphate accumulation (Sawyer, 2015b). The feo ridges are also considered by Sawyer (2015b) to define boundaries or sub-basins within the uplifted lagoon basin.

Geological mapping has also defined two breccia-filled fractures that are orientated northwest-southeast and northeast-southwest (Figure 8). The former fracture is thought to be the eastern edge of the central lagoon (Gerbier, 2015; Sawyer, 2015b).

SASAM identified a number of environmental and cultural features including the location of burial sites and marae that would be excluded from any future exploration or mining plans (Avenir Makatea, 2016; pers. comm. S. Faaeva, 2021). Areas containing extremely deep holes, or where previously mined land has undergone natural regeneration, will also be excluded from any future mining plans. Land that SASAM has identified that meets the criteria mentioned above is shown in Figure 19; this area totals 4.32 km^2.

In 2017, 55 surface samples were reanalysed at ALS for trace elements (methods: ME-MS42 and ME-MS61; appendix B.5). The phosphate samples reanalysed contain a low concentration of other elements (Table 3) including 0.21% Mg, 5.6 ppm Pb and 30.5 ppm Cd.

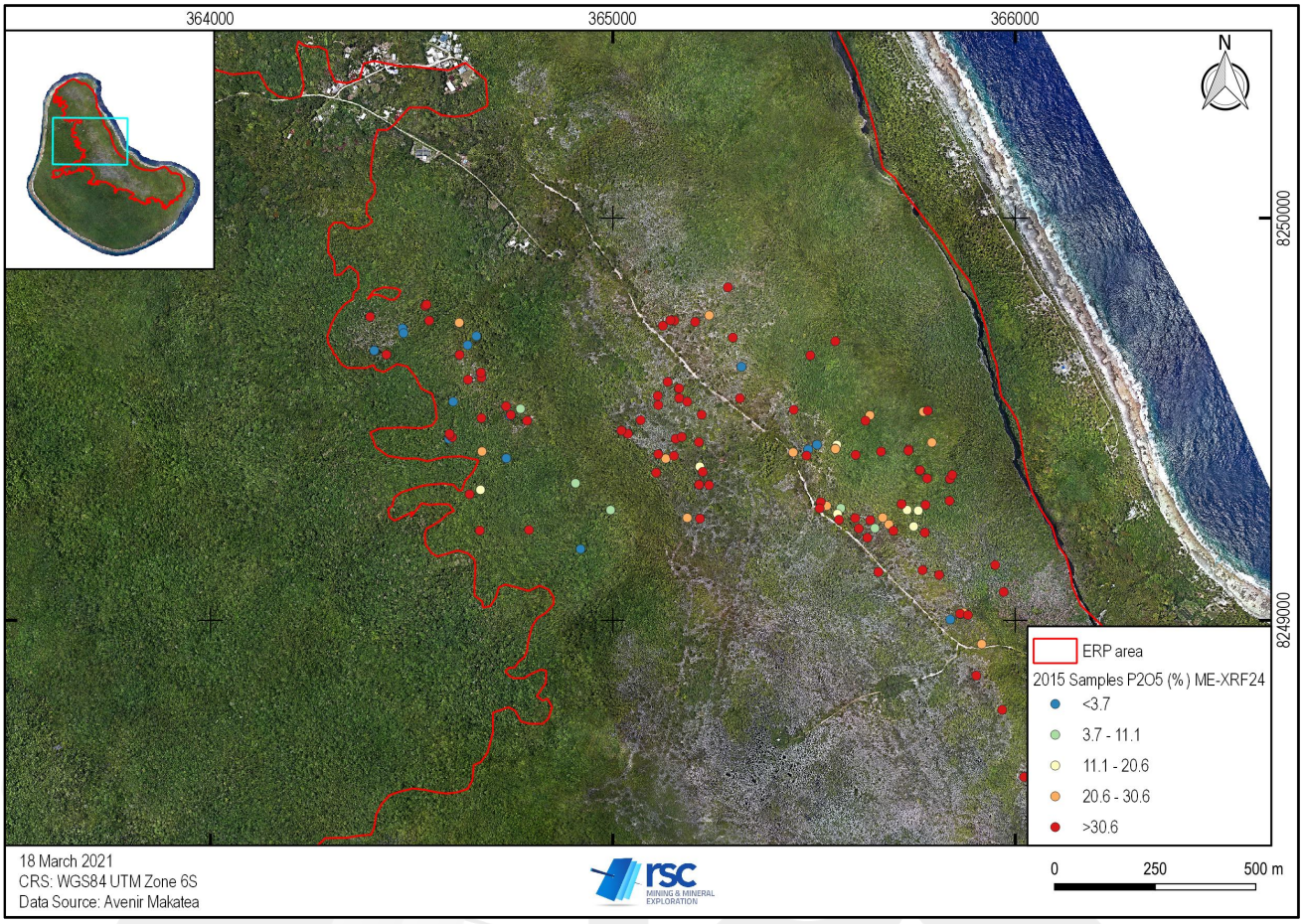

Figure 17: Location of samples collected during the 2015 sampling programme.

Figure 18: Example of photographs taken during the 2015 sample programme. A close up of the material samples and a wider photograph to give context were captured.

Table 3: Summary of a section of the trace elements analysed.

	Al	Ca	Cd	Fe	Mg	Na	Pb	Sr	U
Number	55	55	55	55	55	55	55	55	55
Unit	%	%	ppm	%	%	%	ppm	ppm	ppm
Minimum	0.01	28.0	0.76	0.01	0.03	0.02	0.5	439	3.5
Maximum	0.81	34.7	77.7	0.81	4.97	0.27	19.2	1,660	102
Mean	0.31	33.0	30.5	0.29	0.21	0.10	5.6	898	42.4
Standard deviation	0.20	1.2	22.5	0.19	0.66	0.04	4.6	289	21.8
Coefficient of variance	0.62	0.00	0.74	0.65	3.14	0.40	0.80	0.00	0.50

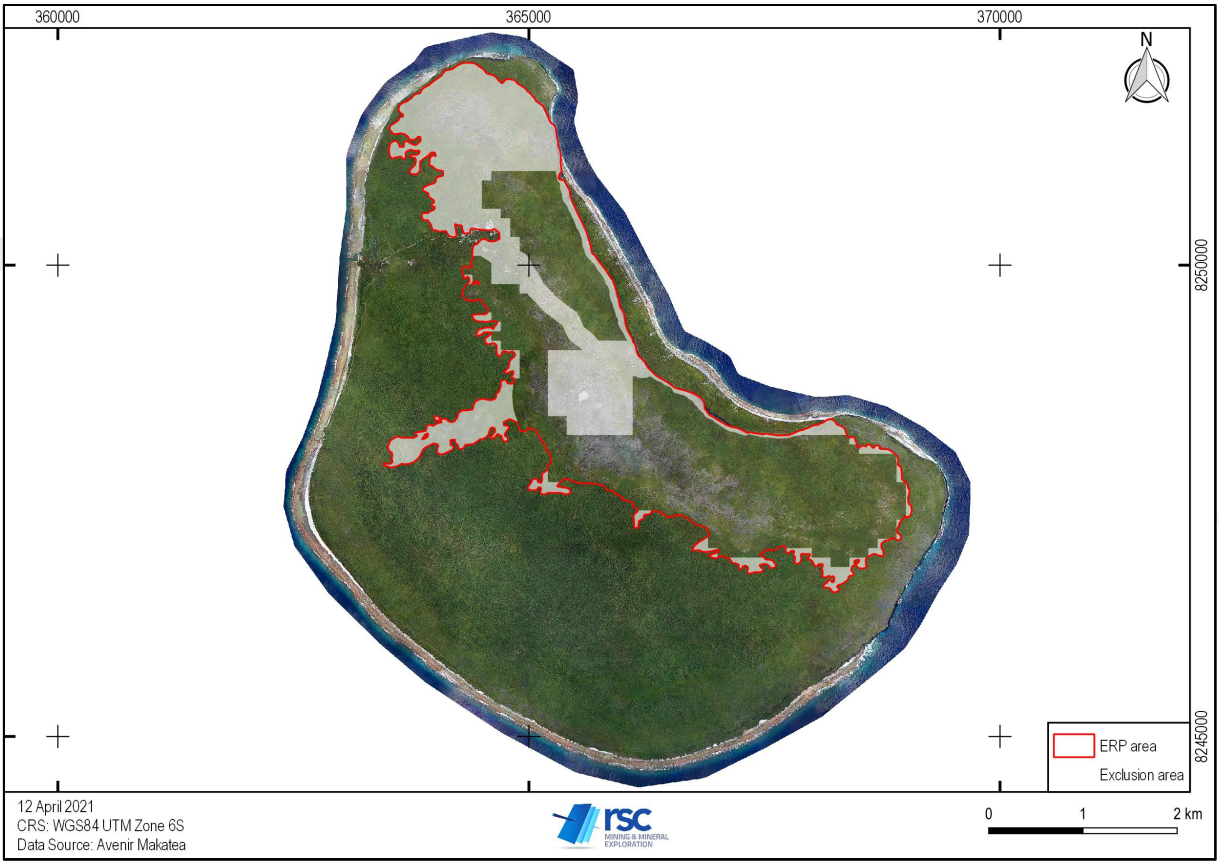

Figure 19: Exclusion areas identified by SASAM.

9.5 2016 Geological Modelling & Analytical

9.5.1 Geological Modelling

Pae Tai Pae Uta (PTPU), a French Polynesian Environmental Consultancy company, was commissioned by Avenir Makatea to reformat the LiDAR survey data. The reformatted data were used by Makatea to inform a geological interpretation of the phosphate deposit at Makatea. A total of 35 environmentally and culturally significant features were identified on the island.

These features, including roads, were classified as exclusion zones (Figure 19). These areas were excluded from the geological modelling. The estimation was conducted using the following assumptions (Avenir Makatea, 2016):

- feo = 1 m thick;
- soft limestone = 4.4 m thick;
- bedded phosphate = 0.6 m thick; and
- bulk density of phosphate = 1.7 g/cm^3.

The broad tonnage potential of phosphate sand was approximated on the basis that 6% of the surface area (e.g. 600 m^2 per ha) had not been previously mined. Therefore, for every 600 m^3, there is 1,000 t of phosphate. The total area of the phosphate extent (area of ERP) is 600 ha, suggesting a total tonnage target of 0.6 Mt of phosphate sand. RSC notes that approximated volumes do not take into account all the karst holes and other natural voids in the limestone. Based on photographs from the exploration programmes, these voids could account for around 50% of land area.

The geological modelling was not conducted by a Qualified Person or completed in accordance with the CIM. The results of the interpretation are presented in Table 4.

Table 4: Approximation of the volume of phosphate, feo and limestone within the ERP (Avenir Makatea, 2016).

Commodity	Area (km^2)	Thickness (m)	Volume (m^3)	Density (assumed) (t/m^3)	Tonnage (Mt)
Feo/dolomite	5.79	1	5,789,000	--	--
Soft Limestone	5.79	4.4	25,471,600	--	--
Bedded Phosphate	5.79	0.6	3,473,400	1.7	5.9
Phosphate Sand	0.0006	1	600	1.7	0.6

9.5.2 Analysis for By-Products

Phosphate is the main commodity of interest to SASAM; however, SASAM has investigated potential by-products of any future phosphate mining, including dolomite and limestone. The dolomite and limestone were sampled and analysed to test their quality as aggregate and food-grade products. The phosphate deposit is capped by hard limestone that has been locally dolomitised. It would be necessary to remove the limestone/dolomite cap during mining to access the phosphate deposit (Figure 20).

In 2016, SASAM returned to the island to collect dolomite samples to test its capacity to be used as aggregate in concrete. RSC has not been provided with any information about the nature or results of this test work and the results are not part of this report.

In 2018, SASAM collected 500 kg of bedded phosphate, phosphate sand, dolomite and limestone (Avenir Makatea, 2018). It is unknown how the samples were selected or collected, and no analyses have been undertaken on the phosphate samples. One sample of limestone was analysed at ALS Brisbane (method ME-XRF26 and ME-MS61), which consists of

35.8% Ca. Seventeen drill samples that were collected in 2014 were re-analysed for trace elements and organic carbon. The drill core contains an average of 53.6% CaO and 11.9% total carbon including 0.06 organic carbon. Sixteen of the drill samples were limestone and one sample was dolomite. The dolomite sample returned a high MgO concentration (17.6%).

As well as use in the aggregate and food supplement market, Avenir Makatea proposes to use the limestone/dolomite cap during the rehabilitation of the island (Avenir Makatea, 2020). RSC has not been provided with any additional information about the nature or results of this test work.

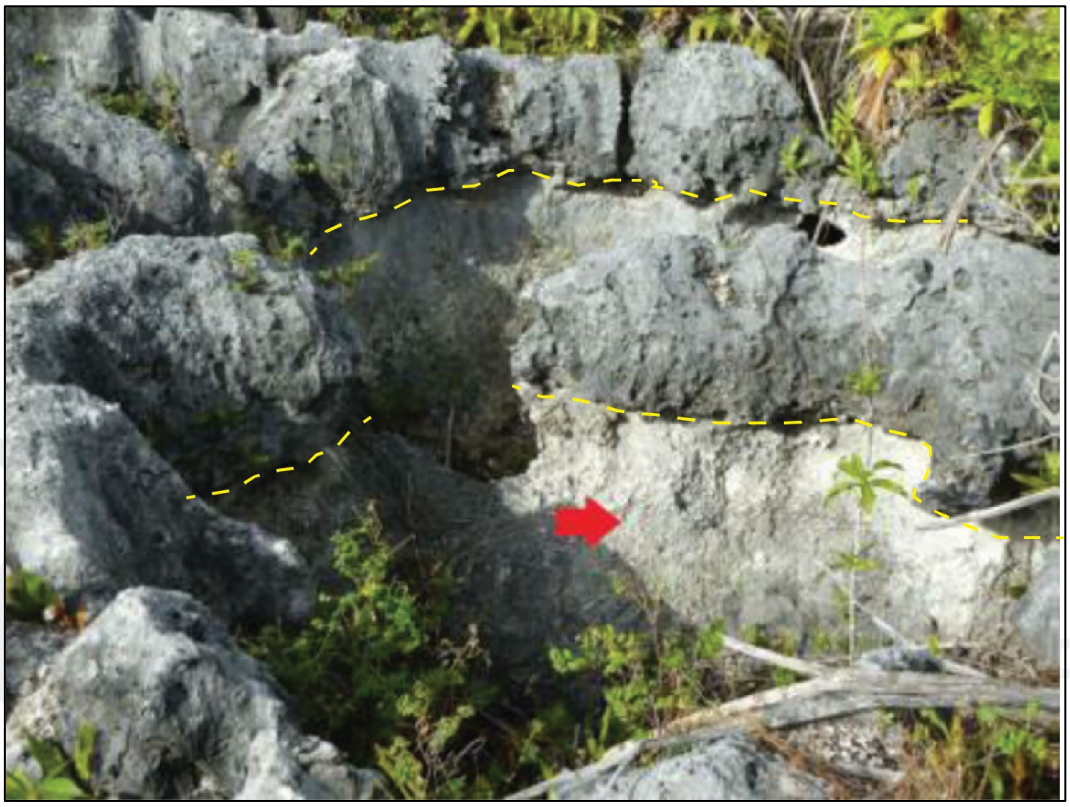

Figure 20: Hard limestone/dolomite (upper, mid-grey unit) forms a capping unit overlying the softer, pale, bedded phosphorite (marked by the red arrow) (Avenir Makatea, 2020). Yellow dashed lines mark the contact between the hard capping unit and phosphate. Removing the capping unit will provide greater access to the phosphate deposit.

9.6 Summary & Interpretation

Table 5 provides a summary of samples collected over the various exploration programmes by Avenir Makatea.

The QP regards the exploration undertaken to date as fit for the purpose of early-stage exploration and the identification of exploration targets. However, the following points are noted:

- The exploration undertaken to date does not provide sufficient information on grade or geological continuity to allow high-confidence mineral resource classification.
- Sample collection has been restricted to the accessible area in the north of the project and no sampling has been undertaken in the southern half of the project.

- Surface samples collected to date have not been collected using appropriate SOPs (i.e. channel sample/trench sampling) and appear to be selected rock-chip samples which are not representative.
- Phosphorite samples collected consistently have a high P_2O_5 concentration and low concentration of deleterious oxides (e.g. Al_2O_3, Fe_2O_3, MgO etc), but the average grade of all the samples collected have been diluted by the collection of barren limestone and dolomite.
- The use of the LiDAR data to constrain any future mineral resource estimates should be treated with caution, and appropriate care taken with respect to thickness, lateral extent, and superposition of the phosphoritic units. The LiDAR survey does not accurately define the base in the karst holes.
- Limited work has been done to define voids in the host rocks.
- Limited work has been done to quantify the historically mined-out areas.

Table 5: Summary of the samples collected and P_2O_5 concentration from various exploration programmes.

	2011 surface samples	2014 surface samples	2014 drill samples	2015 surface samples
No. of samples	62	14	22	137
Minimum P_2O_5%	0.09	30.3	0.20	0.21
Maximum P_2O_5%	37.9	38.5	33.9	39.5
Mean P_2O_5%	10.05	35.5	3.08	27.1
Standard deviation	15.15	2.49	7.39	12.29
Coefficient of variance	1.15	0.07	2.4	0.45

10 Drilling

10.1 SASAM 2014 drilling

One drilling programme was executed by SASAM in 2014. A total of 13 diamond drillholes were drilled for a total of 61.65 m and an average depth of 4.74 m (Table 6). All drill core is 35 mm in diameter. The drillholes were not drilled using a standard diamond rig but instead used a Hilti 350 concrete drill. The drill was fixed to a guide rail that was attached to a fixed-in-place stabilising plate. The stabilising plate was also secured by bolts to a solid substrate (Figure 21. Mr Sawyer (QP) supervised the drill programme and core logging. Core was placed in drill boxes and logged on site. The drillholes were not marked up, as per industry practice, due to the nature of the drilling method and the broken nature of the core. Drilling was carried out with a single rod with no inner tube. As there was no way of preventing the drill core from rotating within the drill rod, grinding together or washing out, the hole depths could not be determined with great accuracy. The core was not always marked up for cutting, but where possible the core was fitted together and a cut line drawn (Sawyer, 2014).

At the end of the drill programme, the core trays were covered with a fitted cover and stacked for transport. The trays were transferred from the wharf via dingy to the waiting transport ship. Once on board the transport ship, the trays were stowed in the goods area for the journey to Papeete. At Papeete, the trays were unloaded and transferred via courier to the PTPU office. The core trays were checked at the PTPU office. Samples selected for laboratory assay were sent to ALS Brisbane.

Drillhole locations are presented in Figure 22. Drillholes were placed within 30 m of the road due to the need to carry/transport equipment, and the limited length of the hose from the water pump and the electrical lead from the generator (Sawyer, 2014). Drilling did not occur at the bottom of karst or pit holes as these were either too narrow and too deep for the drilling equipment (>5 m), or there was no solid substrate to secure the stabilising plate. Many of the holes also hit cavities in the limestone (Sawyer, 2014).

Drilling did not intercept phosphate except for hole MKDH0005, which was deliberately collared through an observable 15-cm layer of white phosphatic sandy sediment lying between limestone units. Lithology logs only record the presence of limestone and caliche.

Recovery of any material other than hard limestone was generally poor. Soft sediments that filled cavities, or were interbedded with harder lithologies, were not returned in the drilling as the water used to flush the drill rod washed away soft unconsolidated or semi-unconsolidated material, including softer chalky limestone, wackestone units or caliche (Sawyer, 2014). It was noted that there were several instances of the drill 'self-drilling', where no or minor material was returned from the drill rod (Sawyer, 2014). The material that the drill was self-drilling through is unknown but is believed to be semi-unconsolidated material; it was also noted that the drilled distinctly dropped when it encountered a cavity (Sawyer, 2014).

The drill samples were analysed in the field using a Niton pXRF analyser, and subsamples were sent to ALS Geochemistry, Brisbane for laboratory XRF (section 11.1.2). From the samples sent to ALS for laboratory assay, only one sample, MKDH0008 0.0–0.3 m, returned a high P_2O_5 concentration (33.9%) and the average P_2O_5 concentration is 3.08% (Table 5). All the remaining assay samples were limestone with varying degrees of dolomitisation (up to 7.51% MgO; appendix B.4).

In 2018, 17 drill core samples were re-analysed for trace elements by ALS Brisbane. The drill samples reanalysed contain a very low concentration of trace elements including 1.1% MgO, 0.14 ppm Cd and Pb concentration was below the detection level (0.5 ppm).

10.2 Summary

The QP regards the drilling undertaken to date as fit for the purpose of early-stage exploration and the identification of exploration targets. However, the following points are noted:

- While drilling orientation is generally oriented perpendicular to the mineralisation, due to the short length of the drillholes, the drilling has not tested the full profile of the mineralisation.
- The 2014 drilling was restricted to the area immediately around the road; thus, only a small portion of the project has been drill-tested.
- Core recoveries are low within the soft, semi-consolidated material (possibly phosphate) and higher in the harder limestone.

Table 6: Summary of the 2014 drill programme (Sawyer, 2014).

ID	Easting	Northing	Inclination	Bearing	Length (m)	Comment
MKDH0001	365112.57	8249750.49	-45	345	4.7	Fossil limestone, remnant phosphate inside of karst.
MKDH0002	365117.12	8249735.03	-90		5.0	Fossil limestone, weak cavity fill — phosphate?
MKDH0003	365145.64	8249369.78	-45	126	3.0	Castellated limestone and phosphate sandstone boulder/sandstone clasts.
MKDH0004	365463.66	8249351.51	-45	219	4.0	Conglomerate inside pit-karst.
MKDH0005	365460.20	8249272.96	-90		5.0	Soft phosphate sand unit below limestone cap.
MKDH0006	365492.45	8249154.11	-60	67	5.0	Remnant phosphate sandstone and loose sand in limestone karst.
MKDH0007	365630.25	8249034.42	-90		6.0	Phosphate/carbonate cross-bedding sandstone unit below limestone cap.
MKDH0008	365781.63	8249039.25	-17	50	5.0	Conglomerate fault fill, karst coating, limestone.
MKDH0009	365788.03	8248926.40	-90		5.0	Remnant landform around limestone tor, phosphate sand.
MKDH0010	365849.75	8248871.47	-90		5.0	Remnant phosphate sandstone cap, old karst pit edge.
MKDH0011	365792.24	8248871.47	-60	13	5.0	Caliche, karst.
MKDH0012	365751.51	8248846.70	-45	145	5.0	Caliche-cavities, phosphate sand.
MKDH0013	365620.21	8248803.32	-45	215	4.0	Caliche, remnant sandstone-loose sand around limestone tor.

Figure 21: Hilti 350 drill assembly (Sawyer, 2014).

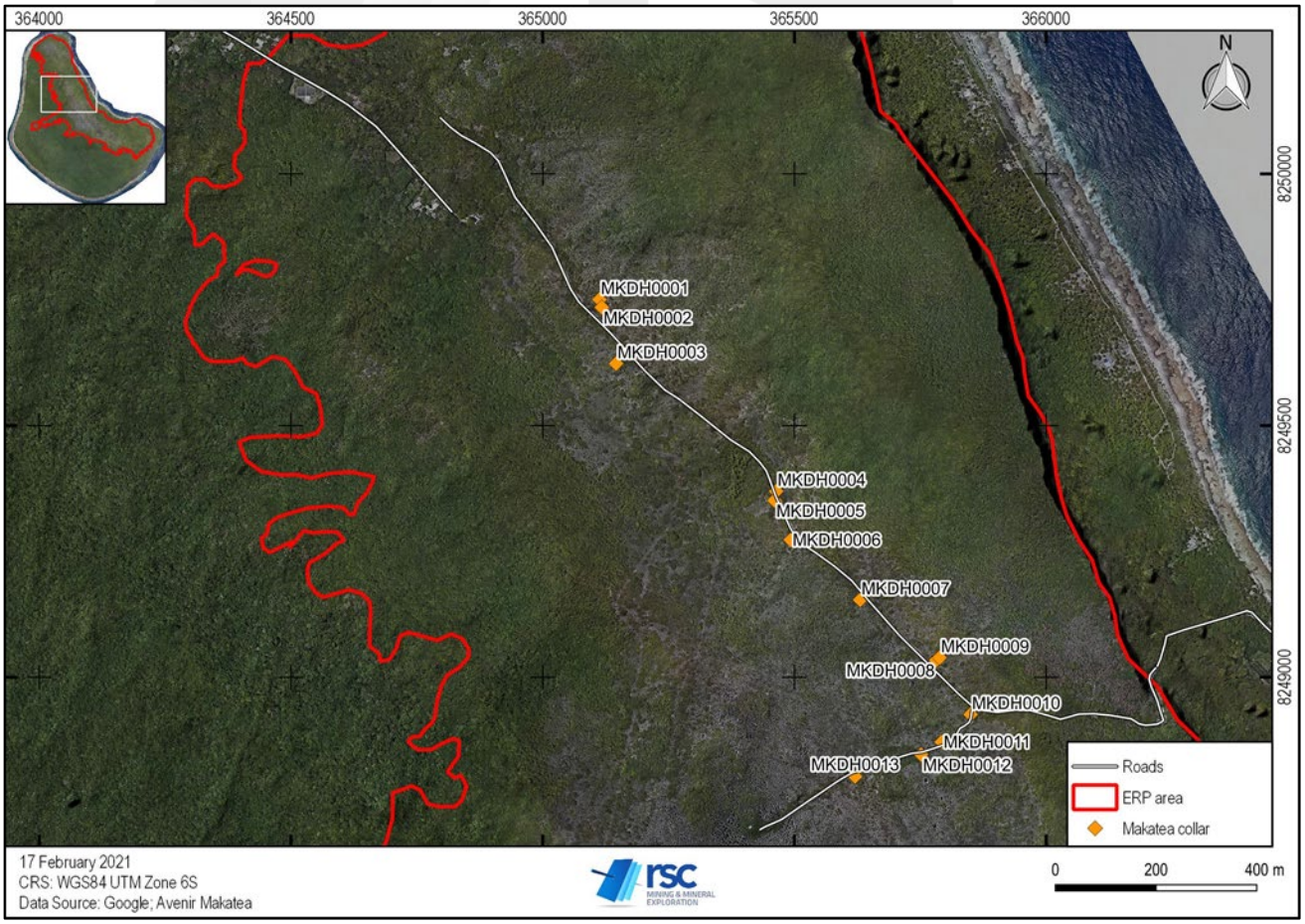

Figure 22: Location of drill collars.

11 Sample Preparation, Analyses and Security

11.1 Sample Preparation and Analysis

11.1.1 Surface Samples

11.1.1.1 2011 Surface Samples

RSC was not provided with an SOP detailing the sample preparation and analysis for the surface samples collected in 2011. The samples were prepared and analysed at ALS Geochemistry, Brisbane, Australia. ALS Geochemistry, Brisbane, Australia, meets all requirements of International Standards ISO/IEC 17025 and ISO 9001. The relationship between ALS and Avenir Makatea is based on a professional association where services are provided for fees based on agreed commercial rates. The samples were crushed to >70% passing 6 mm (method: CRU-21) and pulverised and split following method PUL-21 (pulverised to 85% passing 75 µm). The samples were analysed by XRF (method: ME-XRF12p; Al_2O_3, CaO, Fe_2O_3, K_2O, MgO, MnO_2, Na_2O, P_2O_5, SiO_2, TiO_2).

11.1.1.2 2014 Surface Samples

RSC was not provided with an SOP detailing the sample preparation and analysis for the surface samples collected in 2014. Some of the samples were analysed in situ using a Niton XL3t 950 GOLDD+ pXRF analyser. The samples were sent to ALS Brisbane, where they were prepared and analysed. The samples were crushed to >70% passing 6 mm (method: CRU-21) and pulverised and split following method PUL-23 (pulverised to 85% passing 75 µm) before being analysed by XRF (method: ME-XRF24; Al_2O_3, CaO, Fe_2O_3, K_2O, MgO, MnO_2, Na_2O, P_2O_5, SiO_2, TiO_2).

11.1.1.3 2015 Surface Samples

Samples collected during the 2015 field programme followed the procedures outlined in Sawyer (2015). A total of 147 samples were collected during this sample programme. No duplicate samples were collected.

Rock-chip samples were dried at room temperature for 24–48 hours. Samples were brushed with a dry paintbrush to remove any foreign material, dirt, or dust contaminants. The sample was then placed on a workbench, so it was stable for analysis by pXRF.

Soft material, including phosphate sand and soft limestone, was dried and split into a one-eighth sample using the following steps.

1. Empty dry sample into a clean plastic bowl.
2. Mix sample using a plastic spatula or wooden mixer.
3. Gently break up any large pieces; if they do not break up with gentle pressure, leave as they are.
4. Remix the sample.
5. Leave one-half sample in a bowl and place one half into a second clean bowl using a stiff sheet of plastic for transferring the half sample on.
6. Tip the remaining half back into the sample bag.

7. Clean bowl used, clean spatula, clean wooden mixer with a dry brush; if the wooden mixer is contaminated, dispose of it.
8. Repeat the procedure above on the one-half sample in the second bowl, from steps 2–7, to produce a quarter sample.
9. Repeat the procedure on the quarter sample, steps 2–7, to produce a one-eighth sample.

After a final split (one-eighth) sample was acquired, the sample was split in half again, with half being placed into a labelled 25-mm plastic tube pellet or sample cup for analysis by pXRF. The sample was not crushed or sieved before analysis. The written guidelines reviewed by RSC note that training for the pXRF covered the use of reference material. The provided pXRF dataset includes the analysis of two repeat samples but no analyses of reference material. It is unknown if the results from analysing reference material have been removed from the original dataset or if the training instructions were adhered to.

The samples were analysed in the field using a Niton GOLDD X pXRF analyser. Members of the sampling team were trained in sample preparation and analysis at the beginning of the sample programme by representatives of the pXRF instrument proprietary company. The samples were analysed for a total of 180 seconds. The instrument was pre-calibrated by the rental company (Portable Analytical Solutions) using phosphate samples previously collected from Makatea and analysed in a certified laboratory (Sawyer, 2015b). Llyle Sawyer notes that there was some variation or drift in the reference material analysed; however, these data were not provided to RSC for review. Furthermore, RSC notes that having moisture present in a sample results in potentially significantly low concentrations reported by the instrument (e.g. Parsons et al., 2012); and thus it is critical that samples are completely dry prior to analysis (Gazley & Fisher, 2014). Samples with a pXRF reading of >8% P_2O_5 were also analysed by ALS Geochemistry.

SASAM has compared the pXRF data and laboratory XRF data which reveal significant variation between the two datasets (Figure 23). Overall, there is a general trend that the pXRF underestimated the P_2O_5 concentration, including 27 samples (18% of the dataset) which have an increase of >100% P_2O_5 between the pXRF data and laboratory analysis. However, for 15% of the samples (22 samples), the pXRF overestimated the concentration of P_2O_5. The poor correlation between the pXRF and laboratory dataset is consistent with the QP's expectations of in-situ pXRF analyses where the following factors have probably resulted in a poor relationship between the two datasets including:

- samples that were not completely dry;
- the small analysis spot size of the pXRF instrument;
- the difference in matrix between the samples and the reference material used to calibrate the pXRF instrument;
- the potential for analytical bias between the pXRF instrument and the laboratory data due to lack of reference materials used to calculate a correction factor from within the sample set; and
- difficulties analysing P due to its light atomic number, which means its X-rays are rapidly attenuated in air.

In 2017, 55 phosphate samples were re-assayed at ALS Brisbane for trace elements using inductively coupled plasma mass spectrometry (ICP-MS) (method: ME-MS41 and ME-MS61) to quantify the concentration of undesirable minor elements that can affect the overall quality of the phosphate.

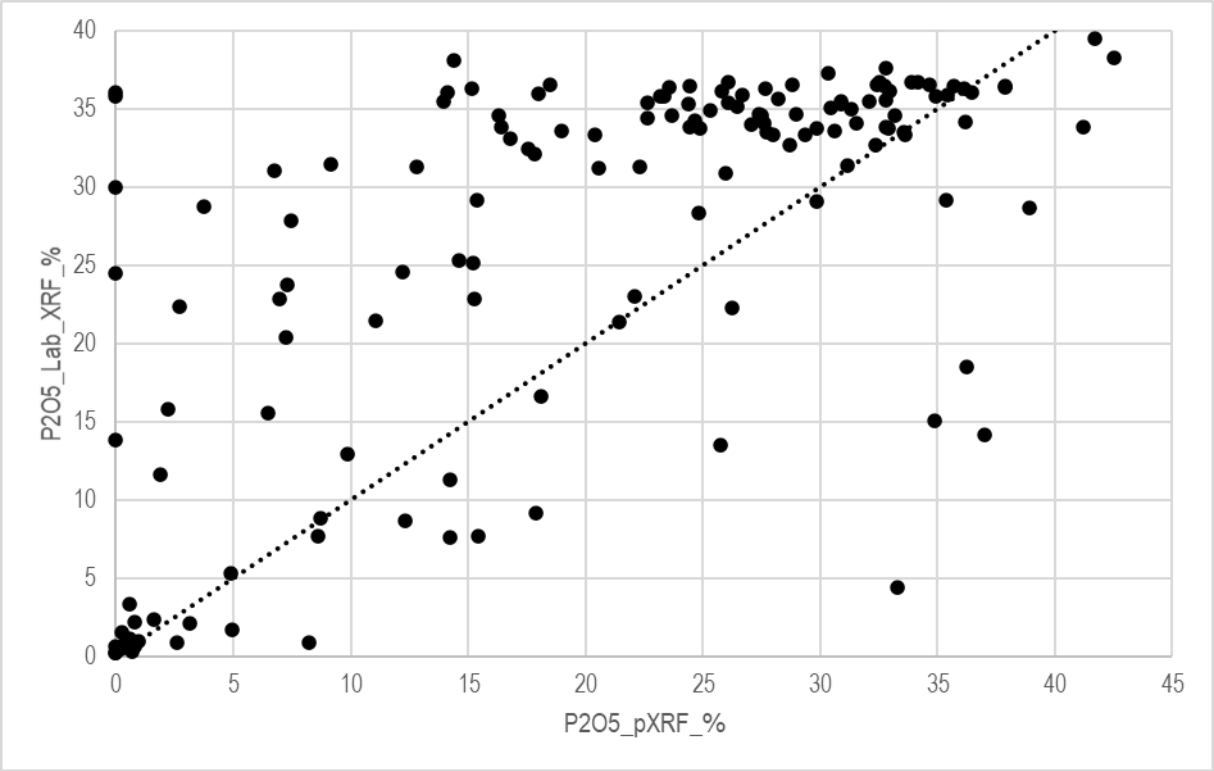

Figure 23: Comparison between pXRF P_2O_5 concentration (x-axis) and laboratory P_2O_5 concentration (y-axis) (Modified from Sawyer (2015b)).

11.1.2 Drill Samples

RSC was not provided with an SOP for sampling the drill core. Selected spots of the drill core were analysed using a Niton XL2t 950 GOLDD+ pXRF analyser. A second window cover was used on the instrument to protect the instrument itself. The instrument was pre-calibrated with samples supplied by Avenir Makatea and re-calibrated to account for the second window cover (Sawyer, 2014). RSC is unsure of the criteria used to select the intervals for pXRF analysis. The QP notes that because P is atomically light, the addition of the additional window will result in additional attenuation of the low-energy P X-rays and thus low concentrations will result.

Twenty-two samples were selected from the pXRF results (>8% P_2O_5) and sent to ALS Brisbane for multielement analysis, using XRF technique ME-XRF24. A rock hammer was used to break the core above and below the selected sample into sections to be sent to ALS. The interval of each sample varied in length from 0.06–0.5 m. As no rock saw was available to use to cut or split the core, the whole core was sent for analysis.

In 2018, 17 limestone samples from the drill core were analysed for trace elements and organic carbon (Table 7) to test the potential of the limestone as a by-product.

Table 7: ALS method codes and analytes for drill core samples.

No. of Samples	Method	Analyte
22	ME-XRF24	Al_2O_3, CaO, Fe_2O_3, K_2O, MgO, MnO_2, Na_2O, P_2O_5, SiO_2, TiO_2
22	ME-GRA05	LOI
17	C-CAL15	Inorganic C
17	C-IR07	C
17	C-IR17	Organic C
17	ME-XRF26	Al_2O_3, BaO, CaO, Cr_2O_3, Fe_2O_3, K_2O, MgO, MnO, Na_2O, P_2O_5, SO_3, SiO_2, SrO, TiO_2
17	ME-GRA05	LOI
17	ME-MS61	Ag, Al, As, Ba, Be, Bi, Ca, Cd, Ce, Co, Cr, Cd, Cu, Fe, Ga, Ge, Hf, In, K, La, Li, Mg, Mn, Mo, Na, Nb, Ni, P, Pb, Rb, Re, S, Sb, Sc, Se, Sn, Sr, Ta, Te, Th, Ti, Tl, U, V, W, Y, Zn, Zr,
17	ME-MS42	Hg
17	F-ELE81a	F

11.2 Density and Moisture Content

Moisture content was not measured in any of the original drill or surface samples. The drilling process used injected water and therefore, the returned samples were wet. The soft surface samples were wet due to rain and humidity. The samples lost a large amount of moisture during transportation to the laboratory, and therefore, any analysis would not have been representative of the moisture content of in-situ samples.

In 2018, 17 limestone drill samples were re-analysed for trace elements and the moisture content of these were measured. Moisture content varied from 0.22–0.76 wt.%, with an average of 0.43 wt.%. However, as the samples were collected in 2014, dried on receipt at the laboratory, and then analysed for moisture content four years later, RSC considers that these results are entirely unrepresentative of the in-situ moisture content of these samples.

Density was not measured for any of the drill or surface samples. The QP regards this as appropriate for an early-stage exploration project but recommends measuring the density of future samples collected. Moisture content would need to be measured in the field, to record accurate and representative results, so that the samples would not gain or lose moisture during the transportation process.

11.3 Sample Security

RSC has not been provided with SOPs concerning sample security or sample transport or details of chain-of-custody, and therefore, the details on sample security regarding any of the surface samples or drill samples are unknown.

11.4 Quality Assurance and Quality Control

This section summarises the systems and processes that were in place to guarantee the quality and confidence in the exploration data. The process is presented in five sections.

1. Statement of Data Quality Objective (DQO).
2. Quality Assurance: SOPs as a tool to prevent errors and limit bias.
3. Quality Control: checks and balances introduced in the relevant sample and measuring processes; and monitoring these actively over the course of the various sample programmes.
4. Quality Acceptance Testing: determining whether the data are fit-for-purpose.

11.4.1 Data Quality Objective

The Makatea Phosphate Project is an exploration project. Most of the project data relate to surface samples with limited drillholes for the purpose of defining exploration targets. The data have been collected for the purpose of reconnaissance exploration and are not intended to be used in mineral resource estimates following CIM guidelines.

11.4.2 Quality Assurance

Good quality assurance (QA) is about error prevention and establishing processes that are repeatable and self-checking. The simpler the process and the fewer steps required the better, as this reduces the potential for errors to be introduced into the sample process. This goal can be achieved using technically sound, simple, prescriptive SOPs and management systems.

11.4.2.1 Location Data

SOPs in relation to the collection of location data were not provided to RSC. SASAM used handheld GPS units with an accuracy of ~2–4 m. It is not possible to check whether the process was appropriate or whether it was correctly carried out in the field. The QP considers this to be suitable for early-stage exploration but will need to be improved for any future resource delineating sampling or drilling.

11.4.2.2 Density Data

No density data have been collected at the Makatea Phosphate Project so far. In the QP's opinion, this is acceptable for this early stage of the exploration programme, but density test work should be included for any subsequent resource delineation work.

11.4.2.3 Surface Samples

Primary Sample

SOPs and written instructions were provided by Llyle Sawyer for some of the critical components of the sample process (section 11). In most instances where no SOPs were in place or no written instructions provided, the process was considered appropriate for early-stage exploration. RSC notes that the collection of surface channel samples did not follow best industry practices due to the difficult access to the sample site, which required samplers rappelling into a karst hole.

First Split

The primary sample was split using a halving process until a one-eighth sample was produced. RSC does have concerns about the splitting method used, as the halving method may introduce unwanted bias especially when large clumps of the sample cannot be broken up with a wooden mixer. The QP considers this to be suitable for early-stage exploration sampling but will need to be improved, for any future resource definition drilling programmes, by drying, crushing and splitting the whole sample using a standardised splitting method (e.g. riffle splitter).

Analytical Phase

The ALS Geochemistry facility, Brisbane, Australia, was not visited by RSC, and no analytical SOPs were reviewed. However, RSC is familiar with ALS' analytical SOPs and the methods being used, and these are considered industry best practice. In the QP's opinion, there is little risk associated with the QA of the ALS analytical stage of the process.

There is some cause for concern with respect to the SOPs surrounding pXRF analysis; as listed in section 11.1.1.3 and evidenced by the poor performance of the samples analysed by pXRF compared to ALS (Figure 23). The QP recommends any future analysis be consistent with industry best practice.

11.4.2.4 Drill Samples

Primary Sample

The primary sample is the 0.06–0.5 m sample extracted by the drill rig. The quality of this sample is determined by how well the core is recovered, and by the amount of contamination, the sample incurs as it is drilled. RSC has not reviewed any SOPs regarding the drilling practices at the Makatea Phosphate Project. Furthermore, with no SOPs in place, it is not possible to assess whether correct processes were followed. This is perhaps acceptable for early-stage exploration drilling but will need to be addressed for further resource definition drilling.

For diamond drilling, sample quality is determined by the drillers' ability to return core samples from the hole. RSC would expect ~80% recovery to be achievable, provided the core is predominantly fresh and not excessively sheared or altered. RSC cannot comment on whether the SOP was followed correctly and whether there was an effective feedback loop to communicate any recovery issues back to the drillers and to improve recovery. These are considered acceptable procedures for early-stage exploration drilling, but more suitable drilling procedures should be used for any future drill programme.

First Split

The first split for the diamond core occurs at the core-cutting phase. There was no rock saw to cut the sample in the field; instead, the sample was broken using a rock hammer. The broken fragments of whole core were sent to ALS Geochemistry, Brisbane, Australia, where it was split lengthwise (method: SAW-01a). RSC has not reviewed any SOPs regarding the splitting processes of drill core. The QP considers this appropriate for early-stage drilling, but the first split of any future drilling should be captured in an SOP and follow industry best practices (e.g. cut with a rock saw).

Second Split

The second split was conducted at ALS Geochemistry, Brisbane, Australia, most likely using a riffle splitter. The method of splitting and the SOP describing this splitting phase were not available to RSC and therefore, have not been reviewed. RSC has not visited the preparation facility at ALS Geochemistry, Brisbane, Australia. The second split occurs after crushing to 70% passing <6 mm (method: CRU-21), which ensures a more representative split, and a smaller chance of bias. The second split was taken from whole split core that was crushed. This process is considered to be appropriate by the QP for early-stage drilling, but RSC would recommend a smaller crush particle size (e.g. <2 mm) in future and the SOP for this stage should be reviewed before progressing the project further.

Third Split

The third split was conducted after pulverisation of the sample to 85% passing 75 µm (method: PUL-21 for 2011 samples; PUL-23 for 2014 and 2015 samples). The method of the split is unknown, but it is assumed to be conducted with a scoop and the sample placed in a paper sample bag. The sample was split, and the remaining sample was retained for any future analysis. An SOP has not been provided for this splitting stage; however, based on RSC's previous experience with this facility, this process appears to be industry standard. In the QP's opinion, there is little risk involved with the quality assurance of this stage of preparation for early-stage drill samples.

Fourth Split

The fourth split occurs to provide the final sub-sample for analysis and is taken from the pulp bag filled by the third split. A 0.7-g sub-sample is taken for XRF. The sample is taken with a scoop from their separate pulp packets. An SOP has not been reviewed for these splitting stages, but RSC is familiar with ALS preparation SOPs and considers them industry standard. Given the size of the sample and the fact that the sample has been crushed, the QP considers this split appropriate for early-stage exploration.

Analytical Phase

The analytical phase of the process involves the analysis of the samples by fused disc XRF analysis. RSC has not reviewed any SOPs for these processes but is familiar with ALS SOPs and the methods (ME-XRF12p, ME-XRF24) being used. They are considered industry best practice. In the QP's opinion, there is little risk associated with the quality assurance of this stage of the process.

The pXRF data collected in the field were appropriate for early-stage exploration. RSC recommends any future pXRF analysis be consistent with industry best practice. As previously mentioned, there is significant cause for concern with respect to the SOPs surrounding pXRF analysis; as listed in section 11.1.1.3, and evidenced by the poor performance of the samples analysed by pXRF compared to ALS (Figure 23).

11.4.3 Quality Control

The purpose of quality control (QC) is to detect and correct errors while a measuring or sampling system is in operation. The outcome of a good QC programme is that it can be demonstrated that errors were fixed during operation and that the

system delivering the data was always in control. For those periods where the system was in control, it can later be determined whether the quality, measured by accuracy and precision, was fit for purpose. The process of quality control is achieved by inserting and constantly evaluating checks and balances.

These QC checks and balances can be incorporated at every stage of the sampling process (location, primary sampling, preparation, and the analytical phase) and, if in place, should be monitored during data collection, allowing the operator to identify and fix errors as they occur.

11.4.3.1 Location Control

No quality control practices are described in the SASAM SOPs for location and no quality control data were available for these steps. No downhole survey was conducted during the drill programme. In the QP's opinion, this is acceptable for the purpose of an early-stage exploration programme but should be implemented for any future resource delineation sampling or drill programmes.

11.4.3.2 Density Data

No density data have been collected.

11.4.3.3 Primary Sample

There were no processes for controlling the quality of the primary sample for the surface samples. No repeat samples were collected. For the diamond drill samples, recovery was logged on site. It is not known whether active QC occurred with diamond drilling, as no SOP was provided to RSC for review. Therefore, RSC cannot comment on whether the sampling was in control or not. In the QP's opinion, this is acceptable for the purpose of delineating exploration targets, but appropriate QC should be implemented for the primary sample in any future resource delineation drilling programmes.

It is always difficult to quantify the quality of the primary sample, collected at the surface or the drill bit. As a proxy, repeat samples or twin drilling and buffered drillhole analysis can be used to assess the variance between samples that are very close to one another. No repeat samples or twin drilling has yet been conducted at Makatea.

Another proxy for quality is core recovery. The results of the core recovery are shown in Figure 24. In general, the core recovery was poor as no soft material was recovered due to the nature of the drill setup. The first four holes have greater recovery than holes MKDH0005–13.

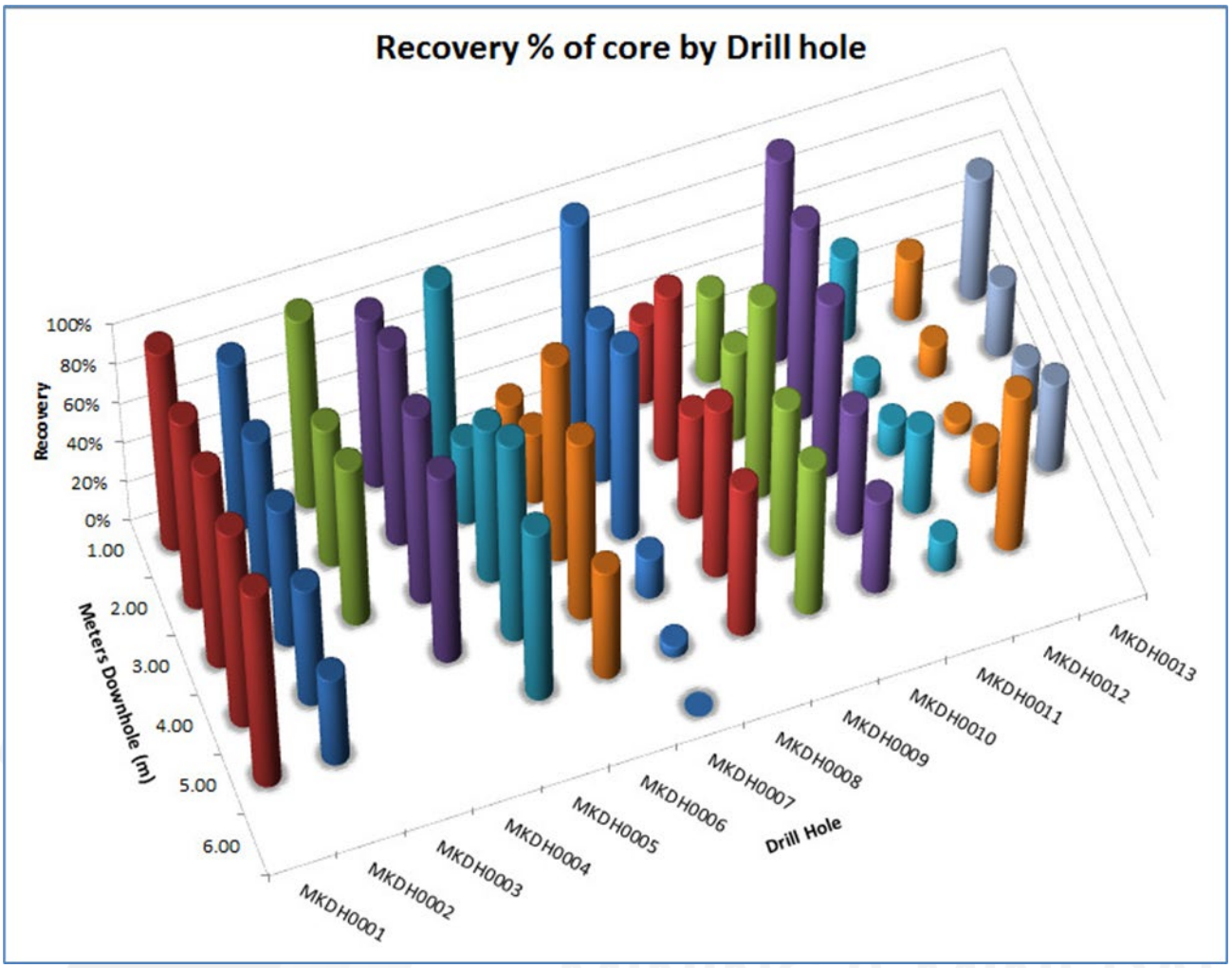

Figure 24: Drill recovery per metre (Sawyer, 2014).

11.4.3.4 First Split

For the surface samples, the first split of the sample occurred at the field operational base using clean bowls to split the sample in half. The quality of this process can be actively controlled by collecting split weights, but this process did not occur during the programme. In the QP's opinion, this is acceptable for the purpose of delineating exploration targets, but appropriate QC should be implemented for the first split in any future resource delineation sample programmes.

For diamond drilling, the first split occurs when the core is cut. No quality control measures are described for this process and no data are available.

11.4.3.5 Second, Third and Fourth Split

Further reduction of sample weight was carried out at the laboratory. SASAM did not collect control data such as duplicate assays at this point; therefore, RSC cannot comment on whether the system was in control. As part of their own internal QC procedures, ALS Geochemistry, Brisbane analysed a small number of duplicate samples for each job. However, RSC does not know at which splitting stage the duplicate was undertaken. In the QP's opinion, this is acceptable for the purpose of

delineating exploration targets, but appropriate QC should be implemented for any splitting stages in any future resource delineation drilling programmes.

11.4.3.6 Analytical Process: ALS

SASAM inserted certified reference materials (CRMs) into the sample stream to control the quality of the analytical process; however, the data, results and outcomes were not available to RSC to review. ALS is an internationally accredited laboratory and employs a rigorous quality control regime. RSC has only reviewed ALS' internal CRM performance for the 2015 surface samples, due to the small number of CRMs submitted in 2011 and 2014. During the 2015 analysis, ALS analysed three CRMs including two phosphorite samples (NCSDC79001 and NCSDC79003). While there are limited CRM data, there appears to be no evidence of special cause variation during the 2015 programme (Figure 25).

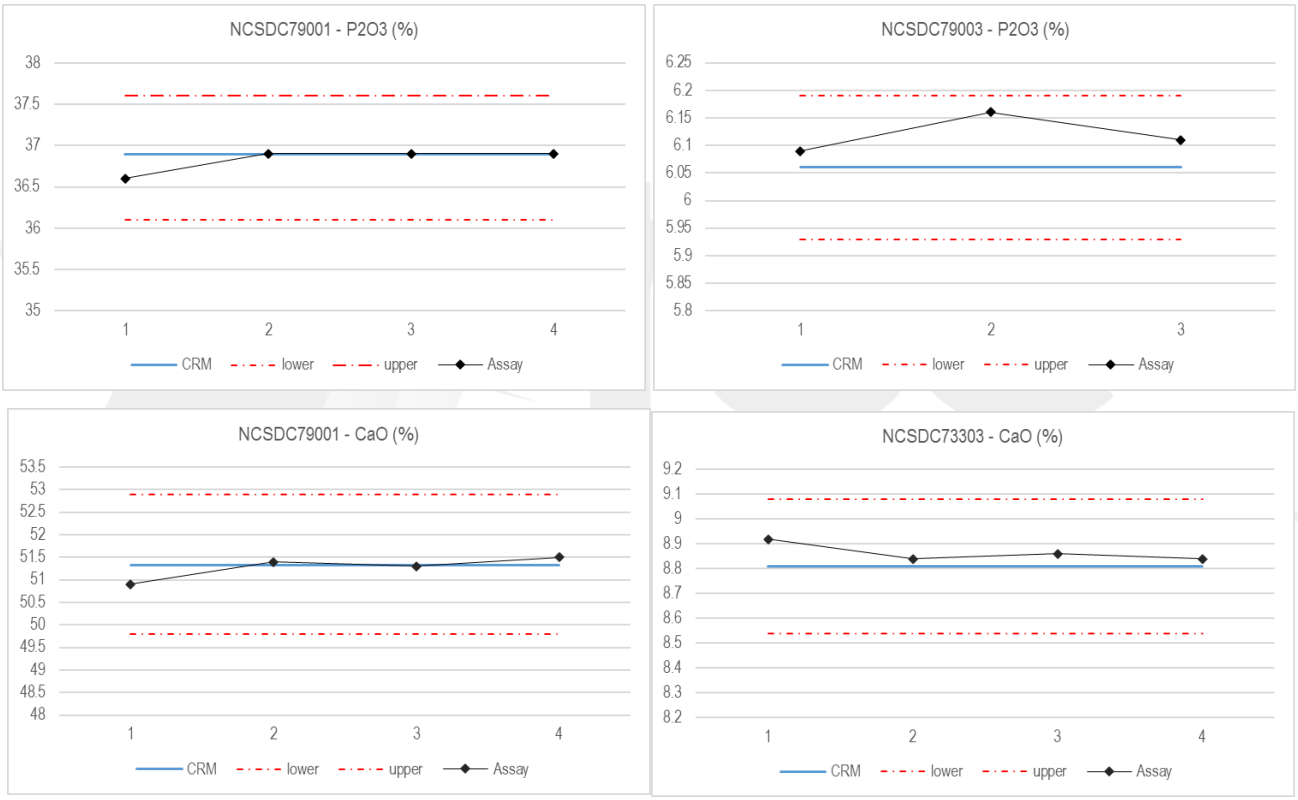

Figure 25: Control plots for P_2O_5 and CaO from CRMs NCSDC79001, NCSDC79003 and NCSDC73303.

11.4.3.7 Analytical Process: in-situ pXRF

CRM data are used to track any variation and to check the pXRF instrument is performing as expected. The written guidelines reviewed by RSC note that training for the pXRF covered the inclusion of standards. The pXRF results for the drill core are reported in Sawyer (2014) and provided the pXRF results from the 2015 sample programme, but no CRM data are included in the report. RSC has not been provided with any raw pXRF data or the 2011 pXRF dataset for the surface samples. It is, therefore, unknown if CRMs were inserted into the sample stream. Therefore, RSC is unable to comment on whether the pXRF analytical process was in control or not. CRMs must be inserted in the sample stream to ensure that the

instrument is stable, to allow for calibration of the instrument with CRMs analysed at the time of the samples (thus capturing any local conditions, e.g. the additional window added to the instrument), and the SiO_2 blank ensures that the instrument is clean. The QP recommends that these steps must be implemented for any further pXRF analysis.

11.4.4 Quality Acceptance Testing

Following the determination that the various processes delivering the data were always in control, now, statistical evaluations of the data quality can be safely made, expressed by their accuracy and precision and relative to their intended purpose.

11.4.4.1 Location Data

No quantitative data were available to comment on pass/fail criteria of sample location data. In the QP's opinion, this is acceptable for the purpose of an early-stage exploration programme.

11.4.4.2 Density Data

No density data have been collected. The QP considers the use of global density assumptions as acceptable for the purpose of an early-stage exploration programme.

11.4.4.3 Primary Sample

No quantitative data were available to comment on pass/fail criteria of primary sample data. In the QP's opinion, this is acceptable for the purpose of an early-stage exploration programme.

11.4.4.4 First Split

No quantitative data were available to comment on pass/fail criteria of the first split data. In the QP's opinion, this is acceptable for the purpose of an early-stage exploration programme.

11.4.4.5 Second, Third and Fourth Split

No quantitative data were available to comment on pass/fail criteria of the second, third and fourth split data. SASAM did not enter any duplicate samples into the sample stream; however, ALS did enter duplicate samples as part of their QC procedures. However, the number of duplicate samples analysed by ALS are too low (n = 5, 5, 7 for 2011, 20104 and 2015, respectively) for any meaningful assessment of the precision and accuracy of the splits. In the QP's opinion, this is acceptable for the purpose of an early-stage exploration programme.

11.4.4.6 Analytical Process: ALS

While it is assumed that the analytical process was in control, during the time the SASAM analyses were analysed at the laboratory (section 11.4.3.6), their quality, as measured by accuracy and precision cannot be determined due to the low number of samples. However, the ALS CRM data reveal no obvious statistically significant differences between the mean of the analytical process and the mean of the CRMs. P_2O_5 analysis of CRM NCSDC79003 is repeatably greater than the CRM mean; however, with only three analysis, no meaningful conclusion can be made.

11.4.4.7 Analytical Process: in-situ pXRF

The quality of the pXRF analysis can be assessed by comparing the pXRF data against laboratory data. Avenir Makatea has previously compared the pXRF data with laboratory XRF data for the 2015 surface samples (Figure 23). It reveals a poor correlation between the two datasets for P_2O_5. RSC was not provided with the pXRF data for the surface samples and, therefore, cannot check or comment on the relationship between other elements analysed. In the QP's opinion, the large variation in the P_2O_5 pXRF means the data should be used with the utmost caution. The SOPs were inadequate (especially with respect to moisture content of samples), it is not possible to QC the instrument performance due to the absence of CRMs in the sample stream, and the overall performance of the instrument against the laboratory data is very poor (Figure 23). The QP notes that with appropriate SOPs and workflows in place, pXRF data can play an important role in the collection of cheap, rapid, early-stage geochemical data at Makatea.

11.5 QP Comments on Sample Preparation, Analyses and Security

The QP regards the sample preparation, analyses and security undertaken to date as fit for the purpose of early-stage exploration and the identification of exploration targets. A summary of the quality of the data at the Makatea project is summarised in Table 8. However, the following points are noted:

- No documentation on the sampling method, security or chain-of-custody details has been provided for the 2011 and 2014 sample programmes.
- The sample reduction methodology for splitting the 2015 samples could be improved by using a simple splitting technique (e.g. riffle splitter). No duplicate samples were taken at this stage preventing an assessment of the precision of the splitting method.
- The 2015 samples have not been dried prior to pXRF analysis. RSC notes that having moisture present in a sample results in potentially lower concentrations reported by the instrument. There is a general trend that the pXRF underestimated the P_2O_5 concentration compared to the results from ALS Geochemistry.
- The 2015 drilling samples were analysed using an extra window on the pXRF; as P is atomically light, the additional window will result in added attenuation of the low-energy P X-rays, and, as a consequence, give lower results.
- Moisture results are not likely to be representative due to environmental conditions, drilling methods and drying out of the samples after their collection.

Table 8: Summary of the quality of the data at the Makatea project for the purpose of early-stage exploration. NA: no data available/insufficient data.

Data Type	QA	QC	Accuracy	Precision	Comment
Location	NA	NA	NA	NA	Data are fit for purpose of defining exploration targets
Density	NA	NA	NA	NA	Insufficient information
Moisture	NA	NA	Assume fail	Assume fail	Needs to be collected in the field at the time of sampling.
Primary Sample	NA	NA	NA	NA	Data are fit for purpose of defining exploration targets
First Split	NA/Pass[1]	NA	NA	NA	Data are fit for purpose of defining exploration targets
Second Split	NA	NA	NA	NA	Data are fit for purpose of defining exploration targets
Third Split	NA	NA	NA	NA	Data are fit for purpose of defining exploration targets
Fourth Split	NA	NA	NA	NA	Data are fit for purpose of defining exploration targets
Analytical Process: ALS	NA	Pass	Assume pass	Assume pass	Data are fit for purpose of defining exploration targets
Analytical Process: pXRF	NA	NA	Assume pass with issues	Assume pass with issues	Data are fit for purpose of defining exploration targets

[1] 2015 surface samples pass. Insufficient information provided for the remaining sampling programmes.

12 Data Verification

A digital database with relevant sampling and assay data was not available for verification. Instead, Mr Sterk (QP), verified ALS certificates provided directly from ALS Geochemistry and Avenir Makatea, as well as reports authored by Geos Mining. Mr Sterk also checked photographs of the sampling campaigns.

Sample methods, locations, preparation, procedures and assay results for the 2014 and 2015 sampling and drill programmes were verified by Mr Sawyer (QP), who was present and supervised these programmes. In Mr Sawyer's opinion the data resulting from these programmes are fit for the purpose of establishing exploration targets.

As neither Mr Sawyer (QP) or Mr Sterk (QP) were present at the 2011 sampling programme and none of the available data (such as photographs) clearly included the sample numbers or coordinates of samples collected, the locations, procedures and assay results of the 2011 samples could not be verified.

Company reports, assay certificates and local press were reviewed to confirm no material changes have occurred since the 2015 site visit. Company financial statements were not made available for review. All efforts were made by the QP to review the information available to check for material changes and is satisfied no material changes have been made regarding the exploration of phosphate on Makatea Island since the 2015 site visit.

13 Mineral Processing and Metallurgical Testing

No metallurgical work has been completed on the project to date.

14 Mineral Resource Estimates

No Mineral Resources have been estimated for the project area.

15 Mineral Reserve Estimates

No Mineral Reserves have been estimated for the project area.

16 Mining Methods

This work has not been conducted and is not required for this report.

17 Recovery Methods

This work has not been conducted and is not required for this report.

18 Project Infrastructure

This work has not been conducted and is not required for this report.

19 Market Studies and Contracts

19.1 Comment on Phosphate Market

Over the last five years, the average price for rock phosphate (Moroccan phosphate, 70% BPL) was USD 89.34/t, with a current (February 2021) price of USD 88.13/t (Figure 26, index mundi, 2021[2]). Phosphate is used in a number of applications including fertilisers, animal feed, detergent, food and beverages, toothpaste, chemicals and metal coatings (GVR, 2019). The predominant use of phosphate is in fertilisers or feed in the agricultural industry (Brunner, 2010; Research & Markets, 2020).

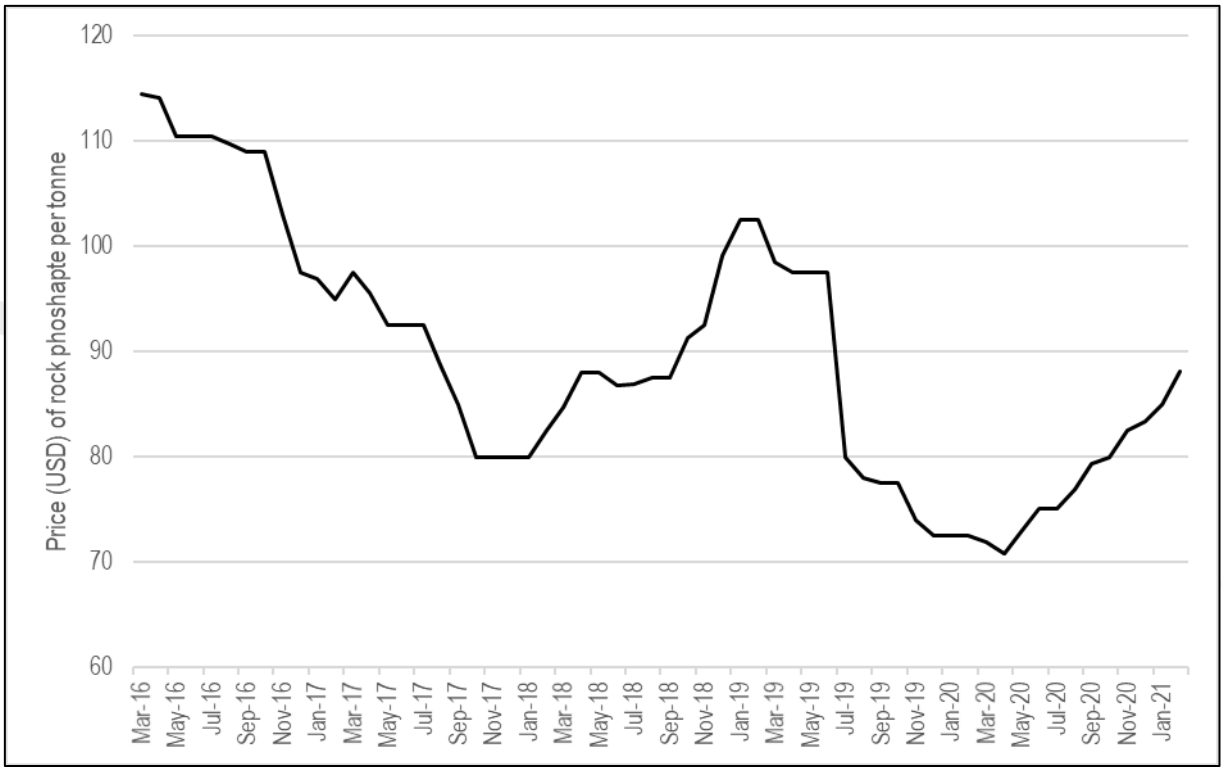

Figure 26: Market price of rock phosphate (Moroccan phosphate, 70% BPL) per tonne over the last five years.

Typically, marketable phosphate ore must meet the following conditions (Kawatra & Carlson, 2014):

- High P_2O_5 grade (>30%);
- Low CaO:P_2O_5 ratio (<1.6); and
- MgO grade lower than 1%.

Additionally, phosphate ore with less than 2–3% Fe_2O_3 and less than 5% Al_2O_3 is desirable for phosphate beneficiation processes. The phosphate samples (P_2O_5 >18%) collected from Makatea are of chemically high-grade (Table 9), although

[2] https://www.indexmundi.com/commodities/?commodity=rock-phosphate&months=60

from the limited trace element data available suggests the phosphate samples contain higher than desired levels of cadmium.

Table 9: Comparison of Makatea phosphate composition with marketable phosphate ore composition requirements. (Kawatra & Carlson, 2014; L. Fourie, per. comms. 2021).

Analyte	Ideal concentration	Averaged composition in Makatea phosphate samples[3]
P_2O_5	>30%	33.2%
$CaO:P_2O_5$	<1.6	1.6
MgO	<1%	0.36%
F_2O_3	<2–3%	0.44%
Al_2O_3	<5%	0.05%
Minor element ratio ($Fe_2O_3 + Al_2O_3 + MgO / P_2O_5$)	<0.1	0.04
SiO_2	<5%	0.06%
Na_2O	<2%	0.14
K_2O	<1.6%	0.01
Cd	<5 ppm	48 ppm
Organic C	<1%	unknown

The rock phosphate market is dominated by demand from the agricultural industry. The demand for phosphate is predicted to grow, driven by the expanding agricultural industry globally and due to the increasing use of phosphates in the food and beverage industry (Research & Markets, 2020).

An additional growing market segment is the direct use of rock phosphate for sustainable/organic agriculture. Also, the need to monitor carbon emissions associated with carbon footprint has prompted the move to crushed rock. While there is a paucity of global market information, the success of entities such as Fertoz in selling products with 20% P_2O_5 indicates the potential of exploring niche markets for potential smaller deposits such as Makatea (Fertoz, 2019). The Organic Materials Review Institute (OMRI) have already certified Avenir Makatea's product 'Moana Phosphate 0-3-0 100% Natural Rock Phosphate' meets the Canadian Organic Standards and is in accordance with the United States Department of Agriculture (USDA) National Organic Program regulations.

The QP recommends that a full marketing study should be undertaken once the specifications of the phosphate, as well as its ability to be upgrade is known. Phosphate, being a bulk commodity, is sensitive to transport costs, and the availability of willing buyers. Potential offtake agreements are critical in understanding the economic viability of a deposit.

[3] Calculated using a lower grade cut-off of 18% P_2O_5 to define 'phosphorite'.

An additional factor that will need to be assessed is how potential extraction methodologies will impact the mined product, particularly with regard to MgO and CaO, given the limestone and dolomitic dominated depositional environment, as well as the karstic nature of the depositional setting. It is recommended that future evaluation of the deposit take representative samples of the relevant country rock to determine the potential outcome of ore dilution, in terms of the introduction of deleterious elements.

20 Environmental Studies, Permitting and Social or Community Impact

This work has not been conducted and is not required for this report.

21 Capital and Operating Costs

This work has not been conducted and is not required for this report.

22 Economic Analysis

This work has not been conducted and is not required for this report.

23 Adjacent Properties

There are no other active research permits or mining titles on Makatea Island or neighbouring islands in French Polynesia.

24 Other Relevant Data and Information

There is no other known relevant data or information other than that which has been presented in this technical report.

25 Interpretation and Conclusions

RSC has compiled an independent technical report for the Makatea Phosphate Project, compliant with Canadian National Instrument 43-101. The project is located on Makatea Island ~240 km northeast of Tahiti. While the island is isolated, the island has been mined for phosphate by CFPO from 1918–1966. The mining was undertaken using non-mechanical methods and approximately 11 Mt of phosphate sands were mined during this time. The mined phosphate was then exported to countries in the wider Pacific to be used fertiliser.

Much of the historical mining targeted phosphate sands, which occur as pockets that fill holes formed by the karstic weathering. In some places the phosphate is hardened and interbedded with the overlying limestone/dolomite; however, this material was not mined by CFPO. The phosphate deposit found at Makatea Island is an example of insular phosphorites, where phosphate was precipitated within an atoll lagoon that has subsequently been uplifted; examples of insular phosphate can be found at Mataiva, Nauru and Banaba/Ocean Island.

Since 2011, Avenir Makatea and SASAM have undertaken three reconnaissance exploration programmes on their 10.36 km^2 EPR at Makatea. Over that period, SASAM has collected 224 surface samples, including phosphorite, limestone, breccia, sandstone, and conglomerate containing phosphorite clasts. Geological sampling and observations from site visits reveal that phosphate occurs as loose sand, bedded phosphorite and phosphorite-bearing breccia. The phosphate deposit is discontinuous, and the lateral and vertical extent of the different phosphate units have not been determined. Samples have returned P_2O_5 concentrations between 0.09% and 39.5%. In 2014, a trial drill programme drilled 13 diamond holes for a total of 61.65 m. As the drilling equipment used water to flush the drill bit, the drill programme had significant recovery issues. The maximum hole depth was 5 m and only MKDH0005 returned phosphate.

RSC notes there are a number of issues with the data quality. The QP regards the sample preparation, analyses and security undertaken to date as fit for purpose for early-stage exploration. The surface samples and drill core were analysed using pXRF and laboratory XRF methods. Comparison between the 2015 pXRF data and laboratory data reveals large variation in regard to P_2O_5, which likely reflects the moisture content of the sample and inadequate workflows.

In addition to the phosphate deposit, there is potential for SASAM to exploit the capping limestone and dolomite (feo) as a by-product. The limestone and dolomite are suitable for use in organic farming and as a feed supplement for a wide range of livestock. However, the QP cannot comment on the potential of these commodities as it is outside the scope of the ITR.

For the purpose of defining an exploration target, SASAM's practices are considered appropriate by the QP; however, there are some shortcomings in SASAM's drilling, sampling, QA and QC practices that are outlined in sections 11 and 12 of this report. While the project hosts a sizeable phosphate deposit, which was successfully exploited historically, significant exploration work still needs to be undertaken in order to determine the size and grade of the deposit. RSC has made recommendations where SASAM needs to improve these practices, as the project advances with additional drilling to be part of a resource definition programme.

26 Recommendations

RSC makes the following recommendations:

- Compile all exploration data into a digital database.
- The drilling programme produced poor recoveries. To advance the project, RSC recommends completing drill programme using a small footprint sonic rig. However, due to the remote nature of the project and irregular topography, the logistics of transporting a sonic drill rig need to be carefully considered.
- RSC recommends an SOP is created that captures chain-of-custody of samples once they leave the field, during sample preparation and prior to dispatch to ALS.
- Repeat samples and CRMs should be collected and analysed, and robust SOPs should be in place to ensure that the QA/QC/QAT process can readily be completed to an acceptable level.
- Improved surveying techniques (collar and down-the-hole) should be put in place for any future resource definition drilling.
- Density and moisture content data need to be collected as part of further drill programmes. The sampling method should be identified in a prescriptive SOP.
- Portable XRF (pXRF) data can play an important role in the collection of cheap, rapid, early-stage geochemical data at Makatea. All samples should be re-analysed with a pXRF, following industry best practices.
- Conduct a DTM survey that can scrutinise the karst holes. This may require a mixture of LiDAR, cavity monitoring systems and conventional surveying.
- Undergo a mapping programme to map the lateral and vertical extent of all known outcrops of phosphorite. Attempt to map out the historically mined areas.
- Complete a full marketing study looking at the specifications of the phosphate ore and its ability to be upgraded. The study should also investigate the potential for ore dilution, in terms of the introduction of deleterious elements.

26.1 Recommended Work Programme

The following exploration work programme is recommended to be undertaken in the next 12 months:

- Stage 1 Data Complication and Field Exploration Programme:
  - Compile exploration data into a digital database.
  - Develop fit-for-purpose SOP and QA/QC/QAT processes for future sampling and exploration programmes.
  - Undertake a high-definition LiDAR survey.
  - Undertake geological mapping and review the extent of the historically mined area in order to better define geological continuity and areas where the phosphate resource has been depleted.
  - Collect a suite of samples across the entire licence area to better determine the phosphate grade continuity, analyse these samples using pXRF in the field at an off-site laboratory.
  - Validate the LiDAR surface.
  - Identify access for Stage 2 drilling programme.

- Stage 2 First-Pass Drill Programme and Reporting:
  - Based on the Stage 1 results, plan and schedule an initial drill programme to test the lateral and depth continuity of the phosphate.
  - Develop access for drilling operations.
  - Undertake a drill programme with the objective of defining exploration targets and if possible inferred mineral resources.
  - Collect bulk samples for metallurgical studies.
  - Based on the drilling and metallurgical results, undertake a marketing study.
  - Undertake a technical report and mineral resource estimation.

26.2 Budget for the Recommended Exploration Programme

An annual budget for a 12-month exploration programme is presented in Table 10.

Table 10: Proposed 12-month exploration budget.

Cost Centre	Estimated time	USD
Compilation of a digital database	<1 month	$5,000
Develop SOPs and QA/QC/QAT processes	1 month	$6,000
LiDAR Survey	1 month	$30,000
Mapping of lithologies and historical areas, plus pXRF sampling	1–2 months	$60,000
Plan drill programme	1 month	$6,000
First-pass sonic drill programme	2–3 months	$370,000
Metallurgical bulk samples	1 month	$50,000
Marketing study	1 month	$20,000
Technical reporting	2 months	$55,000
Total		**$602,000**

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28 Certificates of Qualified Persons

I, René Sterk of 349 Coast Road, 9471 Dunedin, New Zealand, hereby attest that:

- I am Managing Director of the mining and exploration consultancy firm, RSC Consulting Ltd, located at 109 Princes Street, 9016 Dunedin, New Zealand.
- I am a Fellow registered with the AusIMM in Australia (recognised overseas professional organisation) as #303499, in good standing.
- I am a Chartered Professional (CP(Geo)) with the AusIMM.
- I was awarded an MSc degree in Structural Geology & Tectonics from the Vrije Universiteit Amsterdam in 2002.
- Throughout my career, I have practiced continuously as a mining geologist, exploration geologist, manager and consultant for mining and exploration firms in a range of commodities. I have undergone continuing professional development with recognised courses and training seminars.
- I have read the definition of "qualified person" set out in National Instrument 43-101 (NI 43-101) and certify that by reason of my education, affiliation with professional associations (as defined in NI 43-101), and past relevant work experience, I fulfil the requirements to be a "qualified person" for the purposes of NI 43-101.
- I have supervised compilation of all sections of the report. I take overall responsibility for the report entitled "NI 43-101 Independent Technical Report for the Makatea Phosphate Project, French Polynesia", with an effective date of 15 April 2021.
- I have not visited the property.
- I am independent of the issuer, Avenir Makatea Pty Ltd., applying all of the tests in section 1.5 of National Instrument 43-101.
- I am not aware of any material fact or material change with respect to the subject matter of the technical report that is not reflected in the technical report, the exclusion of which would make the technical report misleading.
- I have read National Instrument 43-101 and Form 43-101F1, and the technical report has been prepared in compliance with that Instrument and Form.
- I consent to the filing of this technical report with stock exchanges and other regulatory authorities in Canada, and any publication by them, including electronic publication in the public company files on their website accessible by the public, of the technical report.

Dated this 15 April 2021

_____

René Sterk

MSc FAusIMM CP(Geo) MAIG (RPGeo) MSEG

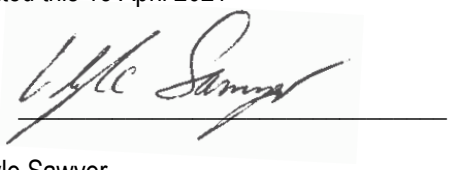
To Accompany the Report titled "NI 43-101 Independent Technical Report for the Makatea Phosphate Project, French Polynesia".

I, Llyle Sawyer, Senior Geologist, do hereby certify that:

- I, Llyle Sawyer, am a senior consultant geoscientist associated with Geos Mining, 301/ 68 Alfred St Milsons Point NSW 2061 Australia.
- I graduated from the University of New South Wales with a Master of Applied Science Degree in Hydrogeology, Engineering Geology and Environmental Geology in 1989.
- I am a registered Geologist / Hydrogeologist of the Australian Institute of Geoscientists under Registration No. 3512.
- I have practiced as a Geologist / Hydrogeologist for the past 30 years.
- During the course of my career, I have performed continuously as a mining geologist, exploration geologist, and consultant for mining and exploration firms in a range of commodities. I have undertaken continuing professional development through recognised courses and training seminars.
- I have read the definition of "qualified person" set out in the National Instrument 43-101 and certify that, by reason of my education, affiliation with a professional association, and past relevant work experience, I fulfill the requirements to be an independent qualified person for the purposes of NI 43-101.
- I take full account for section 2.4 and have provided comment and information to assist with compilation of all sections 2, 7, 9, 10,11 and 12 of the report entitled "NI 43-101 Independent Technical Report for the Makatea Phosphate Project, French Polynesia", with an effective date of 15 April 2021.
- Prior to engagement as a consultant geologist, through Geos Mining, in 2014 I had no previous involvement with the properties that are the subject of the Technical Report.
- I have visited the site from 17th to 31st August 2014, 23rd to 28th April 2015, and 22nd to 27th May 2015.
- I have no personal knowledge as of the date of this certificate of any material fact or change, which is not reflected in this report.
- I am independent of the issuer, Avenir Makatea Pty Ltd., applying all of the tests in section 1.5 of National Instrument 43-101.
- I am independent of RSC Consulting Ltd, located at 109 Princes Street, 9016 Dunedin, New Zealand, applying all of the tests in section 1.5 of National Instrument 43-101.
- I have read NI 43-101 and Form 43-101F1 and have assisted with the preparation of the technical report in compliance with NI 43-101 and Form 43-101F1.
- I have prepared the report in conformity with the generally accepted Canadian Mining Industry practices and, as of the date of the certificate, to the best of my knowledge, information and belief, the technical report contains all scientific and technical information that is required to be disclosed to ensure the technical report is not misleading.
- I consent to the filing of this technical report with stock exchanges and other regulatory authorities in Canada, and any publication by them, including electronic publication in the public company files on their website accessible by the public, of the technical report.

- That as of the effective date of the certificate, to the best of my knowledge, information and belief, the technical report contains all scientific and technical information that is required to be disclosed to make the technical report not misleading.

Dated this 15 April 2021



Llyle Sawyer

Senior Geologist, Geos Mining, M.App.Sc. Geology/Hydrogeology

APPENDIX A: Carbonate Units

Carbonate rocks are classified based on the Dunham classification scheme. Carbonate rocks can be subdivided into two groups: rocks whose original components were bound together during deposition and rocks whose original components were not bound together during deposition (Dunham, 1962). Bafflestones and boundstones are examples of the former, whereas grainstones, packstones and wackestone are all examples of the latter.

- Bafflestone: an autochthonous carbonate rock, with the original components organically bound during deposition. The organisms that form a bafflestone act as baffles.
- Boundstone: a carbonate rock, where the original components are bound together at deposition; consists of intergrown skeletal material, lamination contrary to gravity or cavities floored by sediment.
- Grainstone: a grain-supported carbonate rocks which lacks a mud-size fraction.
- Packstone: a grain-supported carbonate rock which contains mud and fine-grained particles (clay and silt-sized).
- Wackestone: a mud-supported carbonate rock which contains more than 10% of grains.

Another geological unit found at Makatea is caliche. Caliche is a sedimentary rock made up of a calcium carbonate cement binding other material including gravel, sand and silt.

APPENDIX B: Exploration Results

B.1 2011 Surface Samples

2011 assay results (method: XRF-12p) analysed by ALS Geochemistry, Brisbane.

ID	Al_2O_3	CaO	Fe_2O_3	K_2O	MgO	MnO_2	Na_2O	P_2O_5	SiO_2	TiO_2	Total	LOI	Ca:P_2O_5
	%	%	%	%	%	%	%	%	%	%	%	%	
MK 001	0.01	54.9	0.02	<0.01	0.97	<0.01	<0.01	0.22	0.08	0.01	100.4	44.04	250
MK 002	0.01	34.1	0.02	<0.01	18.4	<0.01	0.02	0.13	0.13	<0.01	100	47.08	262
MK 003	0.05	54	0.05	<0.01	1.53	<0.01	0.01	0.14	0.21	0.01	100.45	44.25	386
MK 004	<0.01	52.9	0.02	<0.01	2.86	<0.01	<0.01	0.22	0.02	0.01	100.65	44.49	240
MK 005	<0.01	54.1	0.02	<0.01	1.98	<0.01	<0.01	0.66	0.02	0.01	100.9	43.94	82
MK 006	0.14	53.3	0.16	0.01	0.33	0.02	0.17	24.4	0.03	0.03	98.85	19.94	2.18
MK 007	<0.01	54.8	0.01	<0.01	0.98	<0.01	0.01	0.31	0.01	<0.01	100.4	44.14	177
MK 008	<0.01	53.9	0.01	<0.01	0.9	<0.01	<0.01	0.95	0.02	0.01	99.23	43.31	57
MK 009	<0.01	54.6	0.01	<0.01	0.95	<0.01	<0.01	1.3	<0.01	0.01	100.4	43.37	42
MK 010	<0.01	54.7	0.02	<0.01	1.1	<0.01	<0.01	0.98	0.01	0.01	100.55	43.53	56
MK 012	<0.01	55.2	0.01	<0.01	0.66	<0.01	<0.01	1.1	<0.01	0.01	100.45	43.31	50
MK 013	0.01	55.2	0.02	<0.01	0.58	<0.01	<0.01	0.38	0.02	0.01	100.25	43.9	145
MK 014	<0.01	54.8	0.01	<0.01	0.86	<0.01	0.01	0.91	<0.01	<0.01	100.5	43.72	60
MK 015	<0.01	55.3	0.01	<0.01	0.7	<0.01	<0.01	0.4	0.01	0.01	100.7	44.11	138
MK 016	0.08	51.8	0.04	<0.01	0.27	0.01	0.16	34.5	0.03	0.01	97.75	10.66	1.50
MK 017	<0.01	54.8	0.01	<0.01	1.05	<0.01	<0.01	0.3	<0.01	<0.01	100.35	44.05	183
MK 018	0.01	54.9	0.01	<0.01	0.92	<0.01	<0.01	0.69	0.02	0.01	100.3	43.64	80
MK 019	<0.01	54.9	0.01	<0.01	0.95	<0.01	0.09	0.91	0.01	0.01	100.65	43.61	60
MK 020	0.25	53.2	0.2	<0.01	0.16	0.01	0.16	32.9	0.02	0.04	98.48	11.23	1.62
MK 021	<0.01	55.1	0.01	<0.01	1.06	<0.01	<0.01	0.29	0.01	0.01	100.65	44.02	190
MK 022	<0.01	55.1	0.01	<0.01	0.95	<0.01	<0.01	0.3	0.01	0.01	100.55	44.05	184
MK 023	0.42	52.7	0.3	<0.01	0.14	0.01	0.15	37.3	0.01	0.06	98.29	6.94	1.41
MK 024	<0.01	54.7	0.01	<0.01	1.09	<0.01	<0.01	0.62	<0.01	0.01	100.5	43.9	88
MK 025	<0.01	54.8	0.01	<0.01	0.79	<0.01	<0.01	2.62	<0.01	0.01	100.1	41.73	21
MK 026	<0.01	54.8	0.01	<0.01	0.72	<0.01	0.02	6.27	<0.01	0.01	100.2	38.24	8.7
MK 028	0.01	54.7	0.02	<0.01	0.37	<0.01	0.01	2.09	<0.01	0.01	100.4	42.96	26
MK 029	<0.01	54.6	0.02	<0.01	1.04	<0.01	<0.01	1.04	0.02	0.01	100.05	43.18	53
MK 030	<0.01	55.1	0.02	<0.01	0.74	<0.01	<0.01	0.29	0.01	0.01	100.3	43.99	190

ID	Al_2O_3	CaO	Fe_2O_3	K_2O	MgO	MnO_2	Na_2O	P_2O_5	SiO_2	TiO_2	Total	LOI	Ca:P_2O_5
MK 031	<0.01	55.2	0.01	<0.01	0.67	<0.01	<0.01	1.29	<0.01	0.01	100.35	43.05	43
MK 032	<0.01	55	0.01	<0.01	0.85	<0.01	<0.01	0.78	<0.01	0.01	100.5	43.7	71
MK 033	<0.01	54.9	0.01	<0.01	1.08	<0.01	<0.01	0.19	0.01	0.01	100.6	44.2	289
MK 036	0.47	51	3.23	<0.01	0.13	0.02	0.28	35.6	0.08	0.07	98.63	7.26	1.43
MK 042	0.2	53.1	0.09	<0.01	0.16	0.01	0.27	37.9	0.02	0.03	98.11	5.97	1.40
MK 043	<0.01	54.6	0.02	<0.01	1.2	<0.01	<0.01	0.45	0.01	0.01	100.35	43.91	121
MK 044	<0.01	35.5	0.05	<0.01	16.65	<0.01	0.02	1.5	<0.01	<0.01	99.43	45.58	24
MK 045	<0.01	50.4	0.01	<0.01	4.65	<0.01	<0.01	1.14	0.02	<0.01	100.05	43.74	44
MK 046	<0.01	33.9	<0.01	<0.01	18.35	<0.01	0.02	0.14	0.01	<0.01	99.67	47.13	242
MK 047	<0.01	55.2	0.01	<0.01	0.8	<0.01	<0.01	0.14	0.01	<0.01	100.35	44.09	394
MK 048	0.01	36.5	0.02	<0.01	16	<0.01	0.05	0.92	0.1	<0.01	99.69	45.92	40
MK 049	<0.01	54.5	0.01	<0.01	1.38	<0.01	<0.01	0.47	0.07	0.01	100.5	43.91	116
MK 050	<0.01	54.9	0.01	<0.01	0.97	<0.01	<0.01	0.09	0.03	<0.01	100.45	44.34	610
MK 051	<0.01	54.9	0.01	<0.01	1.08	<0.01	<0.01	0.22	0.01	0.01	100.55	44.14	250
MK 052	<0.01	53.9	0.02	<0.01	1.78	<0.01	<0.01	0.12	0.08	<0.01	100.35	44.34	449
MK 053	<0.01	55.4	0.01	<0.01	0.79	<0.01	<0.01	0.7	<0.01	0.01	100.6	43.57	79
MK 054	<0.01	53.9	0.02	<0.01	1.05	<0.01	<0.01	1.28	<0.01	0.01	100.05	43.62	42
MK 055	<0.01	54.5	0.02	<0.01	1.09	<0.01	<0.01	0.46	0.01	<0.01	100.4	44.13	118
MK 057	<0.01	55.2	<0.01	<0.01	0.89	<0.01	<0.01	0.09	<0.01	<0.01	100.45	44.15	613
MK 058	<0.01	54.8	0.01	<0.01	1.11	<0.01	<0.01	0.54	<0.01	<0.01	100.6	43.98	101
MK 059	*	*	*	*	*	*	*	*	*	*	*	*	*
MK 061	<0.01	35.2	0.01	<0.01	17.1	<0.01	0.03	0.29	0.01	<0.01	99.68	46.9	121
MK 062	0.01	34.7	0.01	<0.01	17.5	<0.01	0.03	0.63	0.01	<0.01	99.63	46.6	55
MK 064	<0.01	54.2	0.02	<0.01	0.92	<0.01	0.02	6.42	<0.01	0.01	100.25	38.52	8.44
MK 011	0.44	51.2	0.35	<0.01	1.84	<0.01	0.17	28.7	0.23	0.07	99.3	15.94	1.78
MK 027	0.19	48.9	0.14	<0.01	0.22	<0.01	0.1	29.4	0.15	0.03	98.48	19.17	1.66
MK 034	0.78	49.6	1.08	0.02	0.17	0.01	0.14	35.8	0.25	0.12	97.93	9.62	1.39
MK 035	1.55	48.3	1.58	<0.01	0.37	0.02	0.25	34.4	0.25	0.27	98.32	10.68	1.40
MK 037	1.5	48	2.71	0.02	0.19	0.03	0.14	34.7	0.12	0.25	98.01	9.42	1.38
MK 038	0.86	50.9	0.92	<0.01	0.18	0.01	0.15	36.8	0.08	0.14	98.14	7.64	1.38
MK 039	1.93	48.5	2.98	0.04	0.17	0.02	0.17	35.5	0.05	0.33	98.42	8.15	1.37
MK 040	0.97	50.8	1.45	0.03	0.2	0.02	0.16	36.6	0.07	0.16	98.27	7.33	1.39

ID	Al_2O_3	CaO	Fe_2O_3	K_2O	MgO	MnO_2	Na_2O	P_2O_5	SiO_2	TiO_2	Total	LOI	Ca:P_2O_5
MK 056	0.88	51.5	0.63	<0.01	0.09	0.01	0.18	36.6	0.02	0.15	98.43	7.9	1.41
MK 060	0.52	51.1	0.5	<0.01	0.12	0.02	0.14	36.1	0.09	0.08	97.69	8.75	1.42
MK 063	0.16	51.6	0.11	<0.01	0.58	<0.01	0.16	35.1	0.02	0.03	97.52	9.57	1.47

MK 059 not received by ALS.

B.2 2014 Surface Samples

2014 surface samples assay results (method: XRF-24) analysed by ALS Geochemistry, Brisbane.

ID	Al_2O_3	CaO	Fe_2O_3	K_2O	MgO	MnO_2	Na_2O	P_2O_5	SiO_2	TiO_2	CaO:P_2O_5	MRE ratio
	%	%	%	%	%	%	%	%	%	%		
MK0071	0.48	51.3	0.4	0.01	0.1	0.02	0.13	35.9	0.02	0.08	1.4	0.03
MK0080	0.27	52	0.19	<0.01	0.08	<0.01	0.06	33.1	0.15	0.05	1.6	0.02
MK0082	0.59	51.8	0.46	0.01	0.12	0.01	0.12	37.1	<0.01	0.09	1.4	0.03
MK0101	0.41	50.1	0.27	0.01	0.13	0.01	0.1	35.2	0.49	0.06	1.4	0.02
MK0102	0.75	50	0.71	0.01	0.1	0.02	0.15	35.6	<0.01	0.13	1.4	0.04
MK0106	0.34	49.2	0.35	0.01	0.19	0.03	0.12	33.9	0.04	0.05	1.5	0.03
MK0065	0.2	53.5	0.18	0.01	0.11	0.01	0.22	38.5	0.44	0.03	1.4	0.01
MK0072	0.18	53.5	0.13	0.01	0.16	0.01	0.16	38.5	<0.1	0.04	1.4	0.01
MK0073	0.43	52.7	0.28	0.01	0.13	0.01	0.16	36.7	0.13	0.07	1.4	0.02
MK0077	0.8	50.8	0.37	0.01	0.09	<0.01	0.13	35.7	<0.1	0.09	1.4	0.04
MK0100	0.45	52.7	0.33	0.01	0.43	0.01	0.11	30.3	<0.1	0.07	1.7	0.04
MK0103	0.15	53.6	0.63	0.01	0.3	<0.01	0.15	31.3	<0.1	0.03	1.7	0.03
MK0104	0.27	53	0.2	0.01	0.08	0.01	0.13	37.2	0.01	0.05	1.4	0.01
MK0105	0.16	52.6	0.13	0.01	0.08	<0.01	0.09	36.4	<0.1	0.04	1.4	0.01

B.3 2015 Surface Samples

2015 assay results (method: XRF-24) analysed by ALS Geochemistry, Brisbane.

ID	Al_2O_3	CaO	Fe_2O_3	K_2O	MgO	MnO_2	Na_2O	P_2O_5	SiO_2	TiO_2	CaO:P_2O_5
	%	%	%	%	%	%	%	%	%	%	
3601	0.1	50.5	0.09	0.01	3.4	<0.01	0.06	12.95	0.12	0.02	3.9
3602	0.16	52.5	0.17	0.01	0.25	0.01	0.2	35.5	0.08	0.04	1.5

ID	Al_2O_3	CaO	Fe_2O_3	K_2O	MgO	MnO_2	Na_2O	P_2O_5	SiO_2	TiO_2	CaO:P_2O_5
3603	1.12	49.2	0.82	0.01	0.11	0.03	0.11	35	0.05	0.19	1.4
3604	<0.01	54.4	0.02	0.01	0.89	<0.01	<0.01	0.84	0.15	0.01	64.8
3605	0.79	50.6	0.56	0.01	0.11	0.02	0.12	35.7	0.1	0.13	1.4
3606	0.1	54	0.07	0.01	0.76	<0.01	<0.01	7.72	0.03	0.03	7.0
3607	1.32	50.9	1.08	0.01	0.08	0.02	0.11	36.6	0.07	0.23	1.4
3608	0.1	52	0.07	0.01	0.08	<0.01	0.14	30.9	0.04	0.03	1.7
3609	<0.01	54.3	<0.01	0.01	0.84	<0.01	<0.01	0.86	0.06	0.01	63.1
3610	0.12	52.4	0.09	<0.01	0.08	<0.01	0.13	35.8	0.06	0.02	1.5
3611	0.92	51.7	0.66	0.01	0.06	<0.01	0.12	36.7	0.08	0.14	1.4
3612	<0.01	53.6	0.01	0.01	0.76	<0.01	<0.01	2.39	0.04	0.01	22.4
3613	<0.01	52.1	0.02	0.02	0.12	<0.01	0.16	32.7	0.04	0.02	1.6
3614	1.2	51	0.84	0.01	0.06	<0.01	0.1	36.7	0.02	0.19	1.4
3615	1.12	50.5	0.87	0.01	0.07	0.02	0.11	36.5	0.03	0.19	1.4
3616	0.64	52.3	0.46	0.01	0.06	<0.01	0.12	36.4	0.06	0.11	1.4
3617	0.7	51.3	0.62	0.01	0.18	0.01	0.13	36.6	0.02	0.15	1.4
3618	0.01	52.8	0.04	0.01	0.15	<0.01	0.36	32.7	0.05	0.02	1.6
3619	<0.01	54.2	0.01	0.01	0.44	<0.01	0.14	13.85	0.01	0.02	3.9
3620	<0.01	53.9	0.02	0.01	0.36	<0.01	0.3	22.3	0.08	0.02	2.4
3621	<0.01	54.7	0.01	0.01	0.12	<0.01	<0.01	4.44	0.01	0.01	12.3
3622	0.03	53.9	0.02	0.01	0.25	<0.01	0.07	11.3	0.03	0.01	4.8
3623	0.023	47.8	0.26	0.01	4.83	0.01	0.12	21.4	0.05	0.06	2.2
3624	0.1	50	0.1	0.01	3.84	<0.01	0.03	7.63	0.06	0.03	6.6
3625	0.14	53.8	0.13	0.01	0.49	<0.01	0.01	8.85	0.13	0.03	6.1
3626	<0.01	54.5	0.01	0.01	0.93	<0.01	<0.01	0.26	0.06	0.01	209.6
3627	0.72	51.6	0.65	0.01	0.12	0.01	0.14	36.6	0.04	0.13	1.4
3628	0.21	43.8	0.2	0.01	8.59	<0.01	0.09	18.5	0.03	0.05	2.4
3629	0.11	53.5	0.1	0.01	0.47	<0.01	0.03	14.15	0.06	0.03	3.8
3630	0.39	52.3	0.26	0.02	0.23	0.01	0.13	31.3	0.08	0.06	1.7
3631	0.39	52.5	0.35	0.01	0.14	0.01	0.15	36.5	0.03	0.08	1.4
3632	<0.01	48.9	0.01	<0.01	4.73	<0.01	0.01	9.2	0.05	0.01	5.3
3633	0.62	49.8	0.5	0.01	0.48	<0.01	0.1	34.1	0.03	0.09	1.5
3634	0.11	51.6	0.13	0.01	1.09	<0.01	0.12	29.2	0.01	0.03	1.8

ID	Al_2O_3	CaO	Fe_2O_3	K_2O	MgO	MnO_2	Na_2O	P_2O_5	SiO_2	TiO_2	CaO:P_2O_5
3635	0.46	52.1	0.32	0.01	0.25	<0.01	0.16	34.3	0.03	0.07	1.5
3636	0.3	52.3	0.25	0.01	0.61	<0.01	0.15	31.1	0.04	0.05	1.7
3637	0.44	51.6	0.31	0.01	0.11	<0.01	0.12	35.4	0.04	0.07	1.5
3638	0.08	52.1	0.06	0.01	0.3	<0.01	0.16	35.6	0.08	0.02	1.5
3639	0.6	50.3	0.63	0.01	0.41	0.02	0.14	35.8	0.05	0.11	1.4
3640	<0.01	53.7	<0.01	0.01	0.92	<0.01	<0.01	1.5	<0.01	0.01	35.8
3641	<0.01	55.1	<0.01	<0.01	0.38	<0.01	<0.01	0.96	<0.01	0.01	57.4
3642	0.25	51.9	0.23	0.01	0.33	<0.01	0.11	33.4	0.04	0.05	1.6
3643	0.26	52.7	0.28	0.01	0.33	<0.01	0.08	23.8	0.04	0.06	2.2
3644	0.83	48.9	0.6	0.01	0.18	0.01	0.08	28.7	0.04	0.14	1.7
3645	0.17	52.5	0.13	0.01	0.13	<0.01	0.14	34.6	0.06	0.04	1.5
3646	0.13	50.5	0.15	0.01	2.43	<0.01	0.11	28.4	0.01	0.03	1.8
3647	0.14	53.1	0.17	0.01	0.19	<0.01	0.17	34.6	0.02	0.04	1.5
3648	0.34	51.8	0.32	0.01	0.22	0.01	0.14	33.4	0.04	0.07	1.6
3649	0.19	50.9	0.18	0.01	2.09	0.01	0.1	23	0.14	0.04	2.2
3650	0.61	51.2	0.62	0.02	0.29	<0.01	0.13	33.4	0.04	0.12	1.5
3651	0.67	51.4	0.38	0.01	0.09		0.13	36.7	0.04	0.1	1.4
3652	0.51	51.9	0.27	0.01	0.07	<0.01	0.11	35.8	0.14	0.06	1.4
3653	0.87	50.6	0.61	0.01	0.07	<0.01	0.1	35.2	0.05	0.14	1.4
3654	0.36	51.7	0.31	0.01	0.3	<0.01	0.14	33.5	0.04	0.07	1.5
3655	0.65	53	0.45	0.01	0.07	<0.01	0.1	34	0.06	0.11	1.6
3656	0.83	51.2	0.53	0.01	0.07	<0.01	0.08	33.8	0.08	0.12	1.5
3657	0.66	52.1	0.59	0.01	0.13	0.01	0.13	35.9	0.05	0.12	1.5
3658	0.44	52.9	0.36	0.01	0.16	<0.01	0.07	25.2	0.13	0.07	2.1
3659	0.29	52.5	0.32	0.01	0.54	0.02	0.16	35.1	0.13	0.07	1.5
3660	<0.01	54.9	0.02	0.01	0.23	<0.01	<0.01	2.16	0.05	0.01	25.4
3661	0.27	52.6	0.25	0.01	0.21	<0.01	0.15	33.9	0.04	0.06	1.6
3662	0.4	51	0.31	0.01	0.17	<0.01	0.11	31.2	0.04	0.08	1.6
3663	0.16	53.3	0.11	0.01	0.08	<0.01	0.13	36.3	0.05	0.03	1.5
3664	0.61	51.1	0.43	0.01	0.21	<0.01	0.11	33.5	0.02	0.1	1.5
3665	0.07	51.3	0.04	0.01	0.3	<0.01	0.14	33.9	0.04	0.01	1.5
3666	<0.01	54.4	<0.01	0.01	0.93	<0.01	<0.01	2.08	0.06	0.01	26.2

ID	Al_2O_3	CaO	Fe_2O_3	K_2O	MgO	MnO_2	Na_2O	P_2O_5	SiO_2	TiO_2	CaO:P_2O_5
3667	0.31	52.8	0.25	0.01	0.17	0.01	0.14	36.6	0.05	0.06	1.4
3701	0.01	51.7	0.03	0.01	2.62	<0.01	0.01	3.31	0.01	0.01	15.6
3702	<0.01	52.9	0.01	0.01	0.2	<0.01	0.24	31.4	0.01	0.01	1.7
4301	1.23	50.3	1	0.01	0.09	0.03	0.12	36.4	0.03	0.22	1.4
4302	<0.01	53.8	<0.01	0.01	0.94	<0.01	<0.01	0.74	0.01	0.01	72.7
4303	<0.01	54	0.01	0.01	0.93	<0.01	<0.01	1.14	0.01	0.01	47.4
4304	0.06	54.7	<0.01	0.01	0.85	<0.01	<0.01	0.34	0.17	0.01	160.9
4305	0.56	52.5	0.46	0.01	0.08	0.01	0.12	30	0.02	0.1	1.8
4306	1.48	50.1	1.22	0.01	0.08	0.03	0.13	36.3	0.03	0.28	1.4
4307	0.77	50	0.64	0.01	0.08	0.01	0.14	34.9	0.04	0.13	1.4
4308	<0.01	54.8	0.01	0.01	0.72	<0.01	<0.01	0.44	0.02	0.01	124.5
4309	0.21	52.9	0.21	0.03	0.56	0.01	0.01	7.66	0.02	0.05	6.9
4310	0.01	53.7	0.03	0.01	0.24	<0.01	0.05	11.6	0.02	0.01	4.6
4311	0.19	53.6	0.16	0.01	0.36	0.01	0.07	13.5	0.06	0.04	4.0
4312	<0.01	54.9	<0.01	<0.01	0.64	<0.01	<0.01	0.21	0.01	0.01	261.4
4313	1.18	48.2	0.99	0.01	0.11	0.1	0.13	33.9	0.04	0.2	1.4
4314	<0.01	52.8	<0.01	0.01	0.46	<0.01	<0.01	0.63	0.01	0.01	83.8
4315	0.46	52.3	0.31	0.01	0.12	<0.01	0.12	29.2	0.03	0.08	1.8
4316	0.31	53.3	0.2	0.01	0.31	<0.01	0.11	24.6	0.11	0.05	2.2
4317	0.12	52.7	0.12	0.01	1.26	<0.01	0.08	16.65	0.01	0.03	3.2
4318	0.047	51.7	0.38	0.02	0.16	0.01	0.16	36.1	0.18	0.08	1.4
4319	0.2	52.1	0.21	0.01	0.58	<0.01	0.15	33.8	0.1	0.05	1.5
4320	0.42	51	0.29	0.01	0.19	<0.01	0.12	34.2	0.04	0.06	1.5
4321	0.53	51.1	0.56	0.01	0.13	0.01	0.15	36.7	0.05	0.11	1.4
4322	1.05	49.3	0.85	0.02	0.15	0.02	0.15	34.6	0.03	0.2	1.4
4323	0.38	52.4	0.32	0.01	0.17	<0.01	0.15	36.3	0.02	0.06	1.4
4324	0.06	52.4	0.06	0.01	0.65	0.02	0.05	15.1	0.05	0.02	3.5
4325	0.25	53.2	0.23	0.01	0.31	<0.01	0.09	22.9	0.01	0.05	2.3
4326	0.5	51.3	0.37	0.01	0.55	<0.01	0.1	25.3	0.03	0.1	2.0
4327	0.37	52.1	0.22	0.02	0.26	<0.01	0.15	33.9	0.05	0.05	1.5
4328	0.7	49.5	0.52	0.01	0.15	0.01	0.14	35.4	0.03	0.1	1.4
4329	0.4	52.6	0.28	0.01	0.2	<0.01	0.15	31.5	0.09	0.06	1.7

ID	Al_2O_3	CaO	Fe_2O_3	K_2O	MgO	MnO_2	Na_2O	P_2O_5	SiO_2	TiO_2	CaO:P_2O_5
4330	0.56	51.7	0.36	0.01	0.19	<0.01	0.14	35.5	0.05	0.08	1.5
4331	0.32	52.1	0.22	0.03	0.42	<0.01	0.2	29.1	0.04	0.05	1.8
4332	0.02	52.7	0.04	0.01	0.78	<0.01	0.01	8.65	0.02	0.02	6.1
4333	0.23	51	0.14	0.01	0.1	<0.01	0.13	33.6	0.04	0.04	1.5
4334	0.26	48.5	0.18	0.01	4.12	<0.01	0.11	20.4	0.08	0.05	2.4
4335	0.44	52	0.4	0.01	0.16	<0.01	0.17	36	0.02	0.08	1.4
4336	0.34	53	0.24	0.01	0.18	<0.01	0.12	31.3	0.05	0.06	1.7
4337	0.37	52.5	0.29	0.01	0.16	<0.01	0.16	36.5	0.02	0.06	1.4
4338	0.72	49.3	0.55	0.01	0.45	<0.01	0.14	33.1	0.06	0.12	1.5
4339	0.12	51.1	0.12	0.01	0.33	<0.01	0.14	33.8	0.08	0.03	1.5
4340	0.28	48	0.24	0.01	5.1	<0.01	0.06	15.55	0.03	0.05	3.1
4341	0.01	53.8	0.02	0.01	0.85	<0.01	0.02	5.29	0.04	0.01	10.2
4342	0.35	52.8	0.25	0.01	0.49	<0.01	0.1	22.9	0.02	0.05	2.3
4343	0.29	53.2	0.28	0.02	0.28	<0.01	0.07	24.5	0.01	0.06	2.2
4344	0.76	51.1	0.56	0.01	0.08	0.01	0.13	36.5	0.02	0.11	1.4
4345	0.58	52.9	0.33	0.01	0.08	<0.01	0.16	38.3	0.04	0.06	1.4
4346	0.21	53.5	0.13	0.01	0.14	<0.01	0.31	39.5	0.02	0.04	1.4
4347	1.04	48.6	0.73	0.01	0.09	0.02	0.13	34.1	0.02	0.16	1.4
4348	0.09	53.5	0.06	0.01	0.44	<0.01	0.12	21.5	0.11	0.02	2.5
4349	0.32	49.9	0.24	0.01	0.08	<0.01	0.12	34.6	0.02	0.05	1.4
4350	0.52	50.1	0.44	0.01	0.13	0.04	0.15	35.3	0.02	0.09	1.4
4351	0.03	34.3	0.01	0.01	17.05	<0.01	0.03	1.73	0.11	<0.01	19.8
4352	0.89	50.6	0.92	0.01	0.08	0.01	0.12	36.2	0.03	0.17	1.4
4353	<0.01	52.5	0.02	0.02	0.19	<0.01	0.31	34.7	0.02	0.02	1.5
4354	1.05	49.6	0.76	0.01	0.1	0.01	0.15	35.8	0.2	0.19	1.4
4355	0.01	54.6	0.02	0.01	1.02	<0.01	<0.01	0.67	0.11	0.01	81.5
4356	0.37	53.1	0.16	0.01	0.1	<0.01	0.15	38.1	0.03	0.03	1.4
4357	0.51	52.4	0.38	0.01	0.13	<0.01	0.18	35.9	0.05	0.1	1.5
4358	0.63	51.1	0.59	0.01	0.09	0.01	0.14	36.2	0.16	0.01	1.4
4359	0.84	50	0.59	0.01	0.07	0.01	0.11	34.7	0.06	0.014	1.4
4360	0.38	53.2	0.33	0.01	0.13	0.01	0.13	27.9	0.03	0.07	1.9
4361	0.91	51.3	0.74	0.01	0.06	0.01	0.14	37.6	0.03	0.016	1.4

ID	Al_2O_3	CaO	Fe_2O_3	K_2O	MgO	MnO_2	Na_2O	P_2O_5	SiO_2	TiO_2	CaO:P_2O_5
4362	0.48	52	0.35	0.01	0.45	<0.01	0.12	32.1	0.09	0.08	1.6
4363	0.7	51.5	0.47	0.01	0.07	<0.01	0.12	36.1	0.02	0.09	1.4
4364	0.66	50.8	0.46	0.01	0.11	0.01	0.13	35.3	0.04	0.12	1.4
4365	0.41	51.8	0.47	0.01	0.11	0.08	0.17	37.3	0.06	0.07	1.4
4366	0.19	53.8	0.14	0.01	0.26	<0.01	0.05	15.85	0.03	0.04	3.4
4367	0.66	52.3	0.53	0.01	0.09	0.01	0.14	33.4	0.03	0.12	1.6
4368	0.6	51.1	0.45	0.01	0.15	<0.01	0.12	35.5	0.02	0.09	1.4
4369	0.97	49.9	0.81	0.02	0.16	0.03	0.16	33.6	0.03	0.16	1.5
4370	0.73	52.3	0.59	0.02	0.18	0.01	0.16	22.4	0.03	0.12	2.3
4371	0.38	52.7	0.29	0.01	0.31	<0.01	0.25	28.8	0.07	0.07	1.8
4372	0.02	53.2	0.02	0.01	0.18	<0.01	0.14	34.4	0.03	0.01	1.5
4373	0.2	51.1	0.13	0.01	0.15	<0.01	0.14	32.5	0.01	0.04	1.6
4374	0.26	53.5	0.15	0.01	0.11	<0.01	0.17	36.1	0.03	0.04	1.5
MK150	0.07	51.9	0.04	0.01	0.3	<0.01	0.16	25	0.11	0.02	2.1
MK151	0.12	52	0.12	0.01	0.11	<0.01	0.16	34.4	0.03	0.03	1.5
MK152	0.06	52.6	0.07	0.01	0.18	<0.01	0.15	29.6	0.07	0.02	1.8
MK0153	0.08	53.8	0.09	0.01	0.34	<0.01	0.11	15.45	0.02	0.03	3.5

B.4 2014 Drill Samples

ID	Al_2O_3	CaO	Fe_2O_3	K_2O	MgO	MnO_2	Na_2O	P_2O_5	SiO_2	TiO_2	CaO:P_2O_5
	%	%	%	%	%	%	%	%	%	%	
MKDH0001 0.5–1.0	<0.01	55.2	0.02	<0.01	0.48	<0.01	<0.01	0.64	0.23	0.01	86.3
MKDH0001 4.25–4.65	0.03	55.1	0.02	<0.01	0.61	<0.01	<0.01	0.2	0.03	0.01	275.5
MKDH0002 0.0–0.5	<0.01	54.7	0.01	<0.01	0.6	<0.01	<0.01	0.66	0.09	<0.01	82.9
MKDH0002 4.5–5.0	<0.01	54.4	0.01	<0.01	0.72	<0.01	<0.01	1.14	0.07	<0.01	47.7
MKDH0004 0.0–0.1	0.15	53.2	0.15	0.01	0.48	<0.01	0.04	12.2	1.08	0.03	4.4
MKDH0004 1.0–1.3	<0.01	46.2	0.01	<0.01	7.51	<0.01	0.03	1.04	0.28	<0.01	44.4
MKDH0004 2.7–2.9	<0.01	50.7	0.01	<0.01	4.23	<0.01	0.01	0.28	0.14	<0.01	181.1
MKDH0005 1.6–1.8	<0.01	54.5	0.01	<0.01	0.76	<0.01	<0.01	0.23	0.24	<0.01	237.0
MKDH0005 2.4–2.6	<0.01	54.4	0.01	0.01	0.9	<0.01	<0.01	0.52	0.28	0.01	104.6
MKDH0006 2.0–2.5	<0.01	54.6	0.01	<0.01	0.78	<0.01	<0.01	0.3	0.02	<0.01	182.0

ID	Al_2O_3	CaO	Fe_2O_3	K_2O	MgO	MnO_2	Na_2O	P_2O_5	SiO_2	TiO_2	CaO:P_2O_5
MKDH0007 0.0–0.3	<0.01	54.8	<0.01	<0.01	0.8	<0.01	0.01	0.41	0.2	<0.01	133.7
MKDH0007 2.75–3.0	<0.01	54.2	0.01	<0.01	0.83	<0.01	0.03	3.91	0.1	0.01	13.9
MKDH0008 0.0–0.3	0.19	53.4	0.18	0.1	0.24	<0.01	0.18	33.9	0.38	0.03	1.6
MKDH0008 0.33–0.45	<0.01	53.8	0.01	<0.01	1.23	<0.01	0.03	0.56	0.1	<0.01	96.1
MKDH0008 3.6–4.0	<0.01	54.1	0.01	<0.01	0.83	<0.01	0.01	3.82	0.05	<0.01	14.2
MKDH0008 4.2–4.5	<0.01	53.3	0.01	<0.01	0.87	<0.01	<0.01	0.22	0.07	<0.01	242.3
MKDH0009 0.45–0.62	<0.01	54.3	0.01	<0.01	0.85	<0.01	0.01	0.87	0.19	<0.01	62.4
MKDH0009 4.55–5.0	<0.01	54.5	<0.01	<0.01	0.93	<0.01	<0.01	0.31	0.1	<0.01	175.8
MKDH0010 1.2–1.5	<0.01	54.5	0.01	<0.01	0.82	<0.01	0.02	4.25	0.23	<0.01	12.8
MKDH00102.5–3.0	<0.01	53.9	<0.01	<0.01	1.09	<0.01	0.02	0.42	0.51	<0.01	128.3
MKDH0012 4.1–4.45	<0.01	54.5	<0.01	<0.01	1.01	<0.01	0.01	0.23	0.07	0.01	237.0
MKDH0013 0.0–0.3	<0.01	54.4	0.01	<0.01	1.01	<0.01	<0.01	1.6	0.18	<0.01	34.0

B.5 2017 Trace Element Analysis

ID	Ag	Al	As	Ba	Be	Bi	Ca	Cd	Ce	Co	Cr	Cs	Cu	Fe
	ppm	%	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm	%
3603	0.05	0.61	<0.2	30	1.08	0.52	30.9	56.3	25.3	0.4	562	<0.05	1.7	0.54
3605	0.02	0.43	<0.2	20	0.82	0.35	32.2	46.7	15.95	0.3	387	<0.05	0.7	0.37
3606	<0.01	0.08	<0.2	10	<0.05	0.02	33.8	1.65	0.8	0.3	79	<0.05	0.5	0.05
3607	0.02	0.69	<0.2	30	1.08	0.5	31.7	67.2	21.8	0.5	621	<0.05	0.4	0.7
3608	<0.01	0.07	<0.2	10	<0.05	0.02	32.4	1.44	0.69	0.4	78	<0.05	<0.2	0.05
3610	0.01	0.08	<0.2	10	0.14	0.03	33.5	5.5	2.58	0.3	189	<0.05	0.3	0.06
3611	0.01	0.49	<0.2	30	0.61	0.32	32.2	38.2	13.7	0.3	428	<0.05	0.2	0.43
3613	<0.01	0.02	<0.2	10	0.05	0.01	31.5	1.11	0.54	0.3	50	<0.05	0.3	0.02
3614	0.02	0.68	<0.2	30	0.71	0.45	33.4	38.3	18.65	0.4	759	<0.05	0.3	0.56
3615	0.02	0.62	<0.2	30	0.9	0.49	31.6	52.8	22.3	0.4	497	<0.05	0.7	0.57
3616	0.01	0.37	<0.2	20	0.19	0.12	33.4	11.55	5.56	0.3	359	<0.05	0.2	0.31
3617	0.02	0.41	<0.2	20	0.75	0.36	32.9	48.3	16.75	0.4	395	<0.05	0.6	0.41
3618	<0.01	0.04	1.1	10	0.05	0.03	33	2.4	1.68	0.3	41	<0.05	0.6	0.03
3619	<0.01	0.02	<0.2	10	0.06	0.04	34	1.49	2.7	0.3	21	<0.05	0.4	0.01
3620	<0.01	0.02	1.1	10	0.05	0.03	33.7	1.19	1.94	0.3	24	<0.05	0.4	0.02

ID	Ag	Al	As	Ba	Be	Bi	Ca	Cd	Ce	Co	Cr	Cs	Cu	Fe
3627	0.02	0.42	<0.2	30	0.69	0.43	32.7	74.4	14.1	0.3	361	<0.05	0.5	0.43
3628	0.02	0.14	<0.2	10	0.12	0.09	28	9.75	2.89	0.5	147	<0.05	0.7	0.13
3635	0.04	0.26	<0.2	20	0.19	0.15	32.3	27	4.18	0.3	231	<0.05	0.4	0.21
3636	0.04	0.18	<0.2	20	0.12	0.1	32.9	17.2	2.48	0.3	187	<0.05	0.5	0.16
3652	0.01	0.25	<0.2	20	0.07	0.05	32.7	5.83	3.61	0.3	340	<0.05	0.2	0.18
3653	0.02	0.48	<0.2	30	0.29	0.25	31.9	23	10	0.4	490	<0.05	0.4	0.4
3654	0.02	0.21	<0.2	20	0.22	0.16	33	21.5	5.51	0.4	237	<0.05	0.6	0.21
3655	0.01	0.35	<0.2	20	0.19	0.18	33.1	17.5	6.29	0.3	377	<0.05	0.3	0.29
3656	0.02	0.47	<0.2	30	0.26	0.21	33.4	23	8.75	0.4	544	<0.05	0.4	0.36
3657	0.02	0.37	<0.2	20	0.75	0.51	33.2	70.4	17.15	0.3	449	<0.05	0.5	0.39
3658	0.01	0.25	<0.2	20	0.08	0.06	33.8	5.25	2.87	0.3	321	<0.05	0.2	0.24
3659	0.08	0.15	<0.2	20	0.25	0.24	32.5	36.6	7.03	0.4	149	<0.05	1.4	0.2
3702	<0.01	0.01	<0.2	10	<0.05	0.02	33.4	0.76	0.73	0.3	31	<0.05	0.6	0.01
4301	0.04	0.7	<0.2	30	1.03	0.68	32.2	63.8	36.2	0.4	574	<0.05	1.8	0.69
4305	<0.01	0.33	<0.2	20	0.52	0.25	33.7	41.4	10.65	0.3	336	<0.05	0.3	0.31
4306	0.02	0.81	<0.2	30	0.83	0.6	31.3	59.5	26.1	0.4	653	<0.05	0.7	0.81
4307	0.01	0.41	0.7	20	0.76	0.37	31	44.4	16.7	0.3	366	<0.05	0.4	0.43
4315	<0.01	0.26	0.3	20	0.18	0.1	32.6	16.7	4.13	0.3	326	<0.05	0.3	0.21
4316	0.01	0.15	0.2	10	0.14	0.1	33.3	29.1	3.13	0.3	140	<0.05	0.5	0.13
4317	0.01	0.08	<0.2	10	0.13	0.08	32.9	18.85	2.51	1.2	68	<0.05	0.8	0.09
4318	0.02	0.27	0.4	20	0.2	0.15	34.3	29.1	4.92	0.5	220	<0.05	0.7	0.27
4319	0.02	0.13	1.7	20	0.13	0.11	34.4	16.6	3.21	0.7	150	<0.05	0.6	0.15
4320	0.02	0.25	<0.2	30	0.14	0.13	34.7	20.6	3.93	0.3	224	<0.05	0.4	0.22
4321	0.03	0.36	<0.2	30	0.46	0.49	34	66.6	15.05	0.3	326	<0.05	0.5	0.38
4322	0.05	0.58	0.4	30	0.44	0.52	31.9	57.4	17.3	0.5	392	<0.05	1.1	0.58
4323	0.03	0.24	<0.2	30	0.21	0.17	34.3	40.6	4.43	0.4	229	<0.05	0.5	0.23
4325	0.02	0.16	1.1	20	0.17	0.13	34.5	25.6	3.64	0.3	161	<0.05	0.8	0.17
4326	0.03	0.28	<0.2	20	0.21	0.22	33.1	25.8	8.23	0.3	232	<0.05	0.7	0.26
4327	0.03	0.21	0.2	20	0.11	0.08	33.3	12.2	2.45	0.3	231	<0.05	0.5	0.15
4328	0.03	0.39	<0.2	20	0.55	0.35	33.1	65.3	10.35	0.3	314	<0.05	0.7	0.37
4329	0.02	0.22	0.9	20	0.17	0.15	34.6	29.2	4.1	0.3	195	<0.05	0.7	0.2
4330	0.05	0.31	<0.2	30	0.23	0.18	33.4	26.9	5.24	0.4	256	<0.05	0.5	0.28

ID	Ag	Al	As	Ba	Be	Bi	Ca	Cd	Ce	Co	Cr	Cs	Cu	Fe
4331	0.05	0.19	<0.2	20	0.16	0.12	33.9	15.55	3.55	0.4	184	<0.05	0.6	0.16
4357	0.01	0.29	1.5	20	0.18	0.2	33.9	18.95	7.03	0.4	343	<0.05	0.6	0.26
4361	0.04	0.53	1.4	30	0.59	0.48	34.6	49	18.8	0.4	590	<0.05	0.8	0.53
4362	0.01	0.28	0.9	20	0.14	0.1	34.6	10.1	3.82	0.4	324	<0.05	0.6	0.26
4367	0.01	0.35	<0.2	20	0.72	0.42	32.5	57.6	17.6	0.3	408	<0.05	0.8	0.35
4368	0.01	0.34	0.5	20	0.14	0.08	32.8	9.23	4.41	0.4	429	<0.05	0.5	0.31
4369	0.06	0.54	1.2	20	0.71	0.45	32.4	77.7	17.75	0.4	343	<0.05	1.4	0.56
4370	0.02	0.39	0.6	20	0.3	0.21	34	44.3	8.15	0.4	253	<0.05	0.8	0.4

ID	Ga	Ge	Hf	In	K	La	Li	Mg	Mn	Mo	Na	Nb	Ni	P
	ppm	ppm	ppm	ppm	%	ppm	ppm	%	ppm	ppm	%	ppm	ppm	ppm
3603	1.99	0.1	0.1	0.104	<0.01	87.3	0.6	0.06	200	0.35	0.08	3.1	1.7	>10000
3605	1.44	0.06	0.1	0.076	0.01	52.1	0.6	0.06	104	0.26	0.08	2.6	1.8	>10000
3606	0.33	0.14	<0.1	<0.005	<0.01	3.5	0.6	0.43	<5	0.06	0.02	0.7	2.6	>10000
3607	2.1	0.11	0.1	0.104	<0.01	68.9	0.5	0.04	127	0.31	0.07	3	1.5	>10000
3608	0.69	0.12	<0.1	<0.005	<0.01	2.3	0.3	0.05	6	0.06	0.11	0.7	2.7	>10000
3610	1.12	0.16	0.1	0.005	<0.01	14.8	0.3	0.05	9	0.11	0.08	0.7	2.3	>10000
3611	1.62	0.12	0.2	0.064	<0.01	42.5	0.4	0.04	33	0.25	0.08	3.1	1.9	>10000
3613	0.59	0.16	<0.1	<0.005	0.01	2	0.3	0.06	<5	0.08	0.11	0.4	3.4	>10000
3614	2.04	0.12	0.2	0.089	<0.01	60.8	0.4	0.03	30	0.28	0.07	2.7	2.1	>10000
3615	1.91	0.14	0.1	0.097	<0.01	77	0.4	0.04	110	0.32	0.08	3.3	1.9	>10000
3616	1.33	0.14	0.1	0.022	<0.01	18.7	0.4	0.03	12	0.19	0.09	2.5	2.4	>10000
3617	1.45	0.14	0.1	0.068	<0.01	60.9	0.4	0.1	77	0.31	0.09	2.7	2.3	>10000
3618	0.62	0.12	<0.1	0.005	0.01	4	0.4	0.09	12	0.16	0.27	0.6	3.2	>10000
3619	0.32	0.19	<0.1	0.009	<0.01	4.2	0.6	0.25	8	0.09	0.13	0.6	3.8	>10000
3620	0.46	0.2	<0.1	<0.005	<0.01	3.8	0.6	0.2	5	0.14	0.23	0.6	3.9	>10000
3627	1.34	0.13	0.1	0.088	<0.01	31.2	0.3	0.06	58	0.53	0.1	2.4	2.3	>10000
3628	0.67	0.21	0.1	0.019	0.01	4.8	1.2	4.97	31	0.11	0.08	1.2	2.8	>10000
3635	1	0.15	0.1	0.03	0.01	6.2	0.4	0.13	19	0.21	0.11	1.7	2.7	>10000
3636	0.79	0.15	0.1	0.023	<0.01	3.1	0.5	0.32	9	0.25	0.11	1.5	3.3	>10000
3652	1.38	0.14	0.1	0.011	<0.01	17.7	0.3	0.04	13	0.14	0.07	2	3.1	>10000
3653	1.49	0.1	0.1	0.051	<0.01	29.1	0.3	0.04	34	0.19	0.07	2.9	2.5	>10000

ID	Ga	Ge	Hf	In	K	La	Li	Mg	Mn	Mo	Na	Nb	Ni	P
3654	0.96	0.11	0.1	0.036	<0.01	10.7	0.3	0.16	29	0.21	0.1	1.6	2.8	>10000
3655	1.25	0.11	<0.1	0.039	<0.01	14	0.3	0.04	12	0.29	0.08	2.5	2.8	>10000
3656	1.4	0.12	0.1	0.048	<0.01	29.4	0.2	0.04	35	0.18	0.07	2.7	3	>10000
3657	1.29	0.14	0.2	0.107	<0.01	38.6	0.2	0.07	35	0.35	0.09	2.5	2.5	>10000
3658	0.92	0.1	0.1	0.013	<0.01	10.8	0.2	0.1	7	0.11	0.05	2	2.9	>10000
3659	0.82	0.12	0.1	0.048	0.01	10.2	0.4	0.28	111	0.32	0.1	1.3	3.1	>10000
3702	0.55	0.16	<0.1	<0.005	0.01	1.9	0.2	0.1	<5	0.14	0.18	0.4	4.3	>10000
4301	1.9	0.19	0.1	0.124	<0.01	131	0.2	0.05	177	0.27	0.08	2.8	2.7	>10000
4305	1.04	0.13	0.1	0.055	<0.01	33.4	0.2	0.05	38	0.27	0.08	1.9	2.7	>10000
4306	1.98	0.14	0.2	0.12	<0.01	81.6	0.2	0.04	166	0.34	0.08	3.1	2.3	>10000
4307	1.27	0.14	0.1	0.073	<0.01	58.7	0.2	0.04	64	0.3	0.1	2.5	2.1	>10000
4315	0.89	0.1	0.1	0.027	<0.01	10.7	0.3	0.07	12	0.18	0.09	1.6	2.6	>10000
4316	0.64	0.12	0.1	0.02	<0.01	6.4	0.3	0.17	16	0.3	0.08	1.1	3.3	>10000
4317	0.46	0.19	0.1	0.016	<0.01	4.2	0.5	0.69	43	0.2	0.07	0.8	4.3	>10000
4318	0.96	0.09	0.2	0.033	0.01	6.6	0.3	0.09	40	0.29	0.11	1.8	2.9	>10000
4319	0.77	0.12	0.1	0.023	<0.01	4.1	0.3	0.32	27	0.2	0.1	1.1	3.3	>10000
4320	0.96	0.13	0.1	0.029	<0.01	6	0.3	0.11	16	0.17	0.09	1.6	2.8	>10000
4321	1.1	0.14	0.3	0.099	<0.01	21.7	0.3	0.07	39	0.45	0.09	2.2	2.3	>10000
4322	1.32	0.12	0.2	0.105	0.01	27.9	0.3	0.09	110	0.49	0.09	3.5	2.3	>10000
4323	0.9	0.13	0.1	0.036	0.01	5.4	0.3	0.1	21	0.28	0.1	1.6	2.6	>10000
4325	0.6	0.13	0.2	0.026	<0.01	4.5	0.3	0.18	14	0.28	0.07	1.3	2.8	>10000
4326	0.85	0.13	0.2	0.046	<0.01	14.9	0.4	0.31	29	0.25	0.08	2.2	3.2	>10000
4327	0.94	0.13	0.1	0.015	0.01	4.3	0.5	0.14	16	0.11	0.1	1.3	2.8	>10000
4328	1.02	0.11	0.1	0.072	0.01	17.7	0.3	0.09	99	0.48	0.1	2	2.3	>10000
4329	0.84	0.13	0.1	0.034	<0.01	5.6	0.4	0.12	17	0.41	0.11	1.5	2.7	>10000
4330	0.95	0.13	0.1	0.037	0.01	7.5	0.3	0.1	22	0.24	0.09	1.7	2.6	>10000
4331	0.77	0.12	0.1	0.022	0.02	4.9	0.7	0.24	23	0.25	0.14	1.3	3.2	>10000
4357	1.02	0.12	0.2	0.042	<0.01	13.2	0.4	0.07	28	0.25	0.11	2.1	3.6	>10000
4361	1.45	0.15	0.3	0.09	<0.01	48.9	0.3	0.04	88	0.32	0.08	3.1	2.3	>10000
4362	1.07	0.13	0.1	0.021	<0.01	10.4	0.3	0.25	11	0.14	0.07	2	2.9	>10000
4367	1.08	0.15	0.1	0.085	<0.01	48	0.3	0.05	48	0.42	0.08	2.1	2.5	>10000
4368	1.18	0.11	0.1	0.016	<0.01	17.2	0.2	0.08	14	0.13	0.07	2.2	2.7	>10000

ID	Ga	Ge	Hf	In	K	La	Li	Mg	Mn	Mo	Na	Nb	Ni	P
4369	1.28	0.14	0.1	0.082	0.01	53.6	0.3	0.09	146	0.72	0.1	2.3	2.4	>10000
4370	0.87	0.12	0.1	0.042	0.01	23.4	0.4	0.11	64	0.48	0.12	2.1	3	>10000

ID	Pb	Rb	Re	S	Sb	Sc	Se	Sn	Sr	Ta	Te
	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm	ppm
3603	14.5	0.1	<0.002	0.04	0.26	4.2	2	0.8	1300	0.08	0.06
3605	10.1	0.1	<0.002	0.04	0.2	2.9	2	0.6	1080	0.06	0.05
3606	1.1	0.1	<0.002	0.02	0.18	0.1	1	0.2	641	<0.05	<0.05
3607	13.7	0.1	<0.002	0.03	0.14	3.9	2	0.8	1360	0.06	<0.05
3608	0.9	<0.1	<0.002	0.03	0.31	0.1	1	<0.2	527	<0.05	<0.05
3610	2.2	<0.1	<0.002	0.04	0.34	0.2	2	0.2	439	<0.05	<0.05
3611	8.7	<0.1	<0.002	0.03	0.16	2.2	2	0.6	1360	0.11	0.06
3613	0.6	0.2	<0.002	0.06	0.47	0.1	1	<0.2	478	<0.05	<0.05
3614	11.4	<0.1	<0.002	0.02	0.25	3.1	2	0.7	1480	0.05	0.06
3615	14.1	0.1	<0.002	0.04	0.19	3.6	2	0.7	1290	0.08	0.07
3616	3.9	0.1	<0.002	0.02	0.15	1	2	0.5	929	0.09	<0.05
3617	10.9	0.1	<0.002	0.04	0.18	2.9	2	0.5	1030	0.06	0.06
3618	1.1	0.1	<0.002	0.23	2	0.4	2	<0.2	957	<0.05	0.07
3619	0.9	0.1	<0.002	0.1	0.33	0.5	2	<0.2	778	<0.05	0.05
3620	0.7	0.1	<0.002	0.22	2.37	0.4	2	<0.2	1070	<0.05	0.06
3627	9.4	<0.1	<0.002	0.04	0.22	2.9	2	0.5	1010	0.05	0.05
3628	1.7	0.1	<0.002	0.02	0.2	0.6	1	0.2	510	<0.05	<0.05
3635	2.8	<0.1	<0.002	0.04	0.16	0.9	2	0.3	716	0.07	<0.05
3636	1.9	<0.1	<0.002	0.04	0.19	0.5	1	0.3	751	0.05	<0.05
3652	2.6	<0.1	<0.002	0.02	0.41	0.4	1	0.4	714	0.09	<0.05
3653	5.5	<0.1	<0.002	0.04	0.29	1.6	2	0.5	968	0.09	<0.05
3654	3.3	<0.1	<0.002	0.03	0.23	1.1	1	0.3	724	<0.05	<0.05
3655	3.9	<0.1	0.002	0.02	1.13	1.1	1	0.5	1020	0.05	<0.05
3656	6.2	<0.1	<0.002	0.02	0.27	1.3	1	0.5	1040	0.08	<0.05
3657	10	<0.1	<0.002	0.03	0.21	2.9	1	0.5	1000	0.06	<0.05
3658	2.4	<0.1	<0.002	0.02	0.26	0.4	1	0.3	674	0.09	<0.05
3659	4.1	<0.1	<0.002	0.04	0.16	1.5	1	0.3	596	<0.05	<0.05

ID	Pb	Rb	Re	S	Sb	Sc	Se	Sn	Sr	Ta	Te
3702	0.5	0.1	<0.002	0.14	0.74	0.2	1	<0.2	656	<0.05	0.06
4301	19.2	<0.1	<0.002	0.04	0.21	5.4	2	0.9	1660	0.06	0.06
4305	7.4	<0.1	<0.002	0.05	0.15	1.7	1	0.4	949	0.05	0.05
4306	15.1	<0.1	<0.002	0.03	0.22	4.1	2	0.8	1610	0.06	<0.05
4307	11.2	<0.1	<0.002	0.06	0.23	2.5	2	0.5	1150	0.07	0.06
4315	3.1	<0.1	<0.002	0.03	0.26	0.7	1	0.3	622	0.06	<0.05
4316	2.3	<0.1	<0.002	0.03	0.29	0.7	1	0.2	748	<0.05	<0.05
4317	1.7	<0.1	<0.002	0.03	0.2	0.5	1	<0.2	445	<0.05	<0.05
4318	2.9	0.1	<0.002	0.04	0.25	1	1	0.3	701	0.07	<0.05
4319	1.9	<0.1	<0.002	0.03	0.24	0.6	1	0.2	616	<0.05	<0.05
4320	2.6	<0.1	<0.002	0.02	0.14	0.7	1	0.3	699	0.06	<0.05
4321	8.2	<0.1	<0.002	0.04	0.12	2.8	2	0.5	952	0.07	<0.05
4322	9.4	<0.1	<0.002	0.06	0.2	2.9	2	0.7	1215	0.1	0.05
4323	3	<0.1	<0.002	0.03	0.2	0.8	1	0.3	684	0.06	<0.05
4325	2.3	<0.1	<0.002	0.07	0.3	0.7	1	0.2	656	0.06	<0.05
4326	4.2	<0.1	<0.002	0.06	0.28	1.3	1	0.4	971	0.08	<0.05
4327	1.8	<0.1	<0.002	0.03	0.27	0.5	1	0.2	615	0.05	<0.05
4328	7	<0.1	<0.002	0.06	0.29	1.9	2	0.4	922	0.05	<0.05
4329	2.7	<0.1	<0.002	0.05	0.28	0.8	1	0.3	995	0.06	<0.05
4330	3.3	<0.1	<0.002	0.03	0.17	1	1	0.4	755	0.06	<0.05
4331	2	0.1	<0.002	0.15	0.13	0.7	1	0.3	635	0.05	<0.05
4357	3.9	<0.1	<0.002	0.05	0.34	1.2	1	0.4	876	0.09	<0.05
4361	9.6	<0.1	<0.002	0.03	0.27	2.8	2	0.6	1205	0.12	0.05
4362	2.9	<0.1	<0.002	0.03	0.42	0.5	1	0.4	794	0.08	<0.05
4367	10.2	<0.1	<0.002	0.03	0.37	2.7	1	0.4	1030	<0.05	<0.05
4368	3.6	<0.1	<0.002	0.02	0.26	0.5	1	0.4	800	0.1	<0.05
4369	12	<0.1	<0.002	0.07	0.29	2.5	2	0.6	1140	<0.05	0.06
4370	6.2	<0.1	<0.002	0.05	0.33	1.2	1	0.4	836	0.08	<0.05

ID	Th	Ti	Tl	U	V	W	Y	Zn	Zr	Hg
	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
3603	1.6	0.045	0.06	41	5	0.2	116	501	6.4	0.418

ID	Th	Ti	Tl	U	V	W	Y	Zn	Zr	Hg
3605	1.06	0.032	0.03	40.6	5	0.1	72.4	518	1.7	0.422
3606	0.06	0.011	<0.02	3.5	2	<0.1	2.6	7	1.5	0.099
3607	1.46	0.04	0.04	57.2	6	0.2	92.7	761	2	0.716
3608	0.06	0.008	<0.02	12.6	4	0.1	2.2	14	0.5	0.251
3610	0.08	0.009	<0.02	10.2	6	0.2	25.5	16	1.9	0.639
3611	0.97	0.05	0.03	58	5	0.2	58.2	240	9.8	1.11
3613	0.03	<0.005	<0.02	8	5	<0.1	3.3	7	1.1	0.164
3614	1.37	0.028	0.03	71.8	5	0.2	75.2	191	3	1.955
3615	1.54	0.048	0.03	48.7	6	0.2	105	411	4.7	0.868
3616	0.51	0.043	0.02	26.2	8	0.2	18	93	2.8	0.691
3617	1.12	0.042	0.04	46.7	5	0.1	82.7	523	3.4	0.644
3618	0.2	0.007	<0.02	14.8	5	0.1	6.3	28	0.7	0.227
3619	0.38	0.011	<0.02	6.7	2	<0.1	6	27	1.2	0.058
3620	0.26	0.007	<0.02	11.5	4	<0.1	6.4	20	1	0.086
3627	1.16	0.043	0.02	88	5	0.1	54.6	843	4.4	1.365
3628	0.31	0.022	<0.02	24.5	4	0.1	7.8	103	4.4	0.507
3635	0.39	0.034	<0.02	43	4	0.1	11.5	331	5.8	0.963
3636	0.25	0.023	<0.02	46.8	4	0.1	5.8	205	3.9	0.898
3652	0.26	0.029	<0.02	24.1	8	0.2	12.3	24	2.3	0.816
3653	0.82	0.046	0.03	60.3	6	0.2	29.3	157	5.7	1.165
3654	0.45	0.028	0.02	46.4	4	0.1	15.4	233	2.2	0.558
3655	0.57	0.028	<0.02	50.8	9	0.1	16.3	143	1.4	0.523
3656	0.73	0.044	<0.02	44.2	8	0.2	28.6	200	2.7	0.719
3657	1.2	0.049	0.03	102	5	0.1	59.3	732	7.3	0.926
3658	0.28	0.036	<0.02	20.3	6	0.1	7.9	36	3	0.383
3659	0.59	0.028	0.02	40.2	4	0.1	21.8	625	5.6	1.015
3702	0.09	<0.005	<0.02	10.4	5	<0.1	3.3	8	1.2	0.182
4301	2.57	0.031	0.04	44.9	6	0.2	163.5	589	2.5	0.35
4305	0.7	0.031	0.02	63.3	5	0.1	44.7	518	3.4	0.695
4306	1.89	0.035	0.04	54.3	6	0.2	100.5	648	2.7	1.11
4307	1.07	0.044	0.02	49	6	0.2	72.6	452	5.4	1.105
4315	0.33	0.034	<0.02	43.1	9	0.1	12.9	186	4.4	1.285

ID	Th	Ti	Tl	U	V	W	Y	Zn	Zr	Hg
4316	0.26	0.021	<0.02	35.5	5	<0.1	10.4	489	4.6	0.583
4317	0.2	0.014	<0.02	20.9	3	0.1	8.3	332	2.9	0.265
4318	0.4	0.041	0.02	43.1	4	0.1	12.6	448	8	0.76
4319	0.26	0.02	<0.02	34.4	4	0.1	8.1	206	3.5	0.559
4320	0.31	0.032	<0.02	43.1	3	0.1	10	159	6.4	0.817
4321	1.11	0.053	<0.02	81.2	3	0.1	44.7	567	10.4	1.205
4322	1.51	0.072	0.04	66.5	4	0.1	45.5	463	8.5	1.345
4323	0.36	0.031	0.02	54.8	3	0.1	11.2	435	3.6	0.849
4325	0.31	0.025	<0.02	38.6	2	0.1	9.1	298	5.9	0.835
4326	0.76	0.05	0.02	41.1	3	0.1	22.4	232	8.5	1.04
4327	0.22	0.023	<0.02	37.2	3	0.1	6.2	107	2.8	0.853
4328	0.86	0.021	0.02	73.1	3	0.1	33.4	941	1.8	1.335
4329	0.37	0.03	<0.02	42.6	3	0.1	11.3	384	5.4	0.748
4330	0.48	0.033	0.02	42.8	3	0.1	13.2	250	2.4	1.29
4331	0.31	0.026	0.02	31.9	2	0.1	8.5	136	5.5	1.11
4357	0.61	0.048	0.03	43	5	0.1	18.7	211	8	0.862
4361	1.37	0.077	0.04	91.8	5	0.1	56.2	529	10.5	1.265
4362	0.35	0.043	<0.02	26.9	5	0.1	10.3	84	3.1	0.342
4367	1.11	0.032	0.02	66.2	4	0.1	65.9	613	2	0.985
4368	0.38	0.045	<0.02	27.3	5	0.2	14.3	52	4.8	0.581
4369	1.15	0.023	0.02	44.8	4	0.1	74.2	1170	1.6	0.861
4370	0.63	0.052	0.02	29.7	4	0.1	27.6	640	2.7	0.833