REDUCTION REPORT
YEAR 1 (Non-Compulsory)

EL 29464

HODGSON DOWNS

FOR PERIOD ENDING: 4 December 2013

Hodgson Downs   SD 5314   1:250,000
Nutwood         5766     1:100,000

Titleholder: Spectrum Rare Earths
(previously TUC Resources Ltd)

Target Commodities: Rare Earth Elements and Uranium

Report No. 2014-008
Prepared for Spectrum Rare Earths Limited
By Laura Petrella
January 2014

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CONTENTS

1. SUMMARY ........................................................................................................ 1
2. LOCATION AND ACCESS ................................................................................ 2
3. TENEMENT STATUS AND OWNERSHIP ......................................................... 4
4. GEOLOGY ........................................................................................................ 6
5. PREVIOUS EXPLORATION ............................................................................ 10
6. SPECTRUM EXPLORATION .......................................................................... 15
   6.1. Exploration during Year 1 (2013) ............................................................... 15
7. REFERENCES ................................................................................................ 17
8. APPENDIX A: Exploration Data ................................................................. 18

LIST OF FIGURES

Figure 1 Location Map of EL29464 and Dropped Ground Landholders, Lease Numbers displayed inside original EL29464 boundary .............................................. 3
Figure 2 Location Map of EL29458 and Dropped Ground ......................................... 5
Figure 3 Geological Map of EL29458 ........................................................................ 9
Figure 4 Location of EL7190 in relation to EL29464 ................................................ 11
Figure 5: Surface samples location with radiometric map underlying ....................... 16
1. SUMMARY

Hodgson Downs (EL 29464) is situated approximately 500km southeast of Darwin, the Northern Territory. Spectrum Rare Earths Limited (Spectrum) applied for EL 29464 to determine the HREE potential of the area.

The first year non-compulsory reduction was undertaken 21 blocks retained and 102 blocks dropped. This report details exploration carried out by Spectrum on the year 1 relinquished ground for the duration that it was held.

Work during Year 1 of tenure consisted of a review of both NTGS data, compilation of significant results from previous exploration reports and geophysical data review.

The majority of previous exploration concentrated in locating diamonds (kimberlitic pipes). However, kimberlitic indicator minerals are assumed to be sourced from an area located a considerable distance outside the tenement. Exploration for shale hosted Zn-Pb-Ag deposits was also undertaken focussing mainly on the Velkerri Formation of the Roper Group, however the small number of anomalies recorded were considered insufficient to continue exploration. The most recent previous exploration report detailed a desk study undertaken for uranium deposits. Very little other historic data has been carried out for uranium deposits and there is no historic data for REE in the area.
2. LOCATION AND ACCESS

EL 29464 falls in the Hodgson Downs SD 5314 1:250,000 map sheet and the Hodgson (5767) and Nutwood (5766) 1:100,000 map sheets. The licence area is situated approximately 500km southeast of Darwin, Northern Territory.

Access from Darwin is via the Stuart Highway. Vehicle access to the north of the tenement area is via the Roper Highway and station roads to Hodgson River, Nutwood Downs and Cox River. The southern portion of the tenement is accessed via the Carpentaria Highway and then by unsealed and station tracks. Most of the tenement can only be accessed via four wheel drive or helicopter.

Topography for the tenement area is low relief, with some floodplains. The Arnold River is located to the east of the licence area and passes through the most northern portion and the Hodgson River is located immediately to the west of the licence area.
Figure 1 Location Map of EL29464 and Dropped Ground Landholders, Lease Numbers displayed inside original EL29464 boundary
3. TENEMENT STATUS AND OWNERSHIP

EL 29464 was granted on 5 December 2012 and expires on 4 December 2018. It originally comprised of 123 graticular blocks (388.7 sq km). There are no other mining leases or mineral claims shown within the Licence boundaries.

Underlying cadastre is perpetual pastoral lease (PPL) stations owned by two parties:
- PPL 1010, (NT Portion 700) Hodgson River Station, covering the northern part of the Licence, owned by Edward & Elizabeth Hart;
- PPL 1052, (NT Portion 1513) Nutwood Downs Station, covering the southern portion of the licence, owned by Lexcray Pty. Ltd. (A.C.N. 010 613 751)

Tenement Reductions:

<table>
<thead>
<tr>
<th></th>
<th>Blocks retained</th>
<th>Blocks relinquished</th>
</tr>
</thead>
<tbody>
<tr>
<td>First Year Non-Compulsory Reduction</td>
<td>21</td>
<td>102</td>
</tr>
</tbody>
</table>

This report details exploration carried out by Spectrum on the year 1 relinquished ground for the duration that it was held. The blocks retained versus the blocks dropped are illustrated in Figure 2.
Figure 2 Location Map of EL29458 and Dropped Ground
4. GEOLOGY

Regional Geology

The EL lies predominately within the central south-western area of the McArthur Basin. The McArthur Basin is a large, complex depositional basin which extends from Arnhem Land in the north-west to south-east beyond the Queensland border (Plumb et al, 1981). The McArthur Basin lies near the eastern edge of the North Australian Craton adjacent to the Mt Isa Orogen, which was a penecontemporaneous continental margin belt (Plumb et al, 1981).

The North Australian Craton (NAC) contains all the economic diamond deposits of Australia and is also host to many significant base metal, gold and uranium deposits. The NAC formed around 1,850Ma during the Barrumundi Orogeny (amalgamation of the Archaean and early Proterozoic rocks that now form the basement of the NAC). The cover of these basement rocks includes:
- Proterozoic (1820-1600Ma) platform cover sediments;
- Palaeozoic volcanic and sedimentary rocks
- Mesozoic sediments

The only volcanic activity that has occurred in the NAC for the past 500Ma includes:
- 367Ma intrusion of diamondiferous kimberlite (Devonian, Merlin Kimberlite Field)
- 179 Ma (Jurassic, Timber Creek Kimberlite Field)
- 25Ma (Tertiary) lamproite field in the Ellendale, W Kimberly area

Gravity data shows major northwest and northeast trending structures crossing the NAC with kimberlites and lamproites occurring along these structures. These structures are interpreted to be potential pathways for diamondiferous intrusives and other mineralising fluids.

Local Geology

The description of local geology has been adapted from Dunn, P. (1963). 1:250,000 Geological Series Explanatory Notes, Hodgson Downs, NT.

EL 29464 lies predominately in the Proterozoic McArthur Basin. In the west of the licence area, the eastern portion of the Mesozoic Carpenteria Basin (formally the Dunmarra Basin) overlies the McArthur Basin.

The majority of the area is underlain by the Mesoproterozoic Roper Group, a sandstone-siltstone sequence with interbedded shales and minor carbonate rocks. Within EL 29464, three formations of the Roper Group outcrop: the Mainoru Formation, Crawford Formation and Abner Sandstone. The lowest stratigraphic is the Mainoru Formation which is exposed in the north and central portions. It consists of flaggy siliceous and micaceous siltstone and shale; and purple and red flaggy dolomite.

Conformable on the Mainoru Formation is the Crawford Formation. It is a sequence of blocky pink and white sandstone beds, interbedded with micaceous siltstones and fine micaceous sandstone. It is characterised by the presence of glauconite and forms a gentle backslope to ridges of the Abner Sandstone. The occurrence of hummocky cross-beds and slumped siltstone beds and ripped up intraclasts indicates that the Crawford Formation was deposited in a storm dominated near shore environment.
The Abner Sandstone lies conformably on the Crawford Formation and four members crop out in the licence area. The Arnold Sandstone Member is the lowest unit and forms prominent ridges of rough jointed sandstone. It is a blocky and massive friable quartz sandstone. Cross bedding and ripple marks are commonly present.

The Jalboi Member is conformable between the sandstone members: the Abner and Hodgson Sandstone Members. It consists of a fining upward cycle of interbedded conglomerate, sandstone, siltstone and mudstone. It is believed to have been deposited during periods of both alluvial outwash and flood plain deposition and subsequent shallow marine transgression. The Munyi Member is the upper most unit of the Abner Sandstone, comprised of ferruginous sandstone and siltstone and commonly appears as a dark capping on the dip slopes of the Hodgson Sandstone Member. The Munyi Formation is overlain by the Corcoran Formation, which does not outcrop on the tenement as the formation poorly exposed due to soft and fine grained nature of the sediments.

Proterozoic units that overly the Abner Sandstone in the regional stratigraphic sequence are not represented on the tenement.

Uplift and erosion preceded the deposition of Cambrian sandstone. The Lower Cambrian Bukalara Sandstone rests unconformably on Proterozoic rocks. It consists of blocky buff, white and red quartz sandstone with minor shale bands. On eroded Proterozoic sediments as a jointed horizontal capping or in shallow-dipping basins and synclines. Lower Cambrian mafic volcanic, the Nutwood Downs Volcanics, lie immediately west of the EL (not exposed in the EL) and overlie Proterozoic Bukalara Sandstone. The Nutwood Downs Volcanics are equivalent to the Antrim Plateau Volcanics and consist of tholeiitic basalt, agglomerate and tuffs. Sandstone dykes in the basal lava flow suggest it was extruded before the underlying Bukalara Sandstone was lithified.

Thin sequences of flat-lying Cretaceous conglomerate, sandstone, siltstone and mudstone of marine and non-marine origin are widespread in the area. The sediments have more recently been revised into a unit known as the Petrel Formation (Hughes, 1978) previously having been grouped into the Mullaman Formation (Skwarko, 1966).

A land surface developed during the early Tertiary after emergence of the Cretaceous sediments. Weathering in the early Tertiary silicified some of the finer-grained Cretaceous sediments to form porcellanite (Dunn, 1963). The majority of the area is covered by Cenozoic sediments consisting of sand, soil, travertine, rubble and laterite.

Northwest trending faults parallel to and possible extensions of the regional Mallapunya Fault is evident in the tenement. A series of north to north-east trending faults are present within the tenement. The numerous domes and anticlines along these faults suggest mostly strike-slip faulting.
<table>
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<th>Period</th>
<th>Group</th>
<th>Format</th>
<th>Member</th>
<th>Symbol</th>
<th>Description</th>
<th>GeolRegion</th>
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<td>Cenozoic material</td>
<td>Qa</td>
<td>Alluvium</td>
<td>Unconsolidated Material</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Cenozoic material</td>
<td>Czs</td>
<td>Sand, soil, travertine, rubble</td>
<td>Unconsolidated Material</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lower Cretaceous</td>
<td>Petrel Formation?</td>
<td>Kl</td>
<td>Porcellanite, claystone, ferruginous and calcareous sandstone, massive white friable sandstone, plant and marine fossils</td>
<td>Carpentaria Basin</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lower Cambrian</td>
<td>Bukalara Sandstone</td>
<td>Clb</td>
<td>Massive and blocky, buff and red, quartz sandstone with minor shale bands. Prominent cross-bedding. Some slumping</td>
<td>Georgina Basin</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Upper (?)</td>
<td>Roper Group</td>
<td>Munyi</td>
<td>Prm</td>
<td>Ferruginous sandstone and siltstone</td>
<td>McArthur Basin</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Hodgson</td>
<td>Prh</td>
<td>Medium to coarse friable quartz sandstone</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Jalboi</td>
<td>Prj</td>
<td>Blocky quartz sandstone, siltstone micaceous sandstone with slump-structures</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Arnold</td>
<td>Prx</td>
<td>Coarse to medium friable quartz sandstone</td>
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<td></td>
</tr>
<tr>
<td></td>
<td>Crawford Formation</td>
<td>Prr</td>
<td>Blocky quartz sandstone and siltstone. Blocky pink and buff quartz greywacke. Contains glauconite</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Mainoru Formation</td>
<td>Pru</td>
<td>Flaggy siliceous and micaceous siltstone and shale. Purple and red flaggy dolomite</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Figure 3 Geological Map of EL29458
5. PREVIOUS EXPLORATION

Work completed on EL 29464 by Spectrum for this year included a literature review.

Exploration details of the historic tenements intersecting and contained with EL 29464 are summarised below:

**EL26072:** CR2009-0363, CR2010-0391 and CR2011-0932
Location: Same licence area as EL 29464.
Diamantina Uranium Pty Ltd undertook a detailed review of historical exploration in the area and a detailed interpretation of airborne magnetic data from the NTGS. The commodities sought after focussed mainly on the potential for uranium deposits in the area but also for diamonds and Ni-Cu-PGE sulphides.

Diamantina Uranium Pty Ltd outlined how there is increasing evidence for U mineralisation in Carpenteria Basin. Proximity of U-enriched source rocks to Carpenteria Basin sandstone units suggest the potential for sandstone-hosted uranium deposits.
Sandstone-hosted unranium deposits occur in Palaeozoic (Devonian-Carboniferous) continental red-bed sedimentary successions in the Ngalia (uranium mineralisation occurs at a redox boundary that formed due to flushing oxidising groundwater through detrital organic matter) and Amadeus Basins (uranium mineralisation occurs at a redox boundary that formed either by flushing oxidising groundwater through reduced sandstone beds). There is a possibility for one of these types of U-sources to exist.

Eight radiometric anomalies were identified from the airborne magnetic data. No further details targeting these anomalies were given. Due to the lack of evidence to support an extensive exploration programme based on Diamantina’s review of historical data, the tenement was relinquished.

**EL22295:** CR2005-0526 and CR2008-0961
Location: Entirely covering EL 29464 and outside area to the west.
CR2005-0526: Astro Diamond Mines undertook a review of geological, topographic and geophysical data, GIS compilations and data reviews, to explore the regional diamond prospectivity of the area. The area was relinquished as no targets were identified from magnetic or Landsat data.
CR2008-0961: Legend International Holdings carried out a review of historical data and purchased Landsat imagery for target generation. The potential for the tenement to host kimberlitic rocks was considered low due to the lack of kimberlitic indicator minerals. Historic reports of micro and macro diamonds in the project area were interpreted as sourced from rocks to the south of the tenement.

Location: Covering the eastern portion of EL 29464 and large outside area to the N-NE.
EL7190 contains all of the compiled geophysical data for commodities other than diamonds. Unfortunately, the majority of the samples are within the northern portion of EL7190, outside EL 29464.

Maximum geochemical values obtained from EL7190:
- Rock Chips: 406ppm Cu, 330ppm Zn, 26.7ppm Pb and 3ppm U
- Stream Sediment: 145 ppm Cu, 124ppm Zn, 50.9ppm Pb, no U results.
- Gravel: 150 ppm Cu, 216ppm Zn, 70.8ppm Pb, no U results.

CR1992-0161: Stockdale Prospecting Pty explored for diamonds, base metals and Au in EL7190. Geochemical gravel and stream sediment investigation determined that a spatial relationship occurs between particulate barite and galena and enhanced Cu, Pb and Zn values in a drainage system in the NE of the licence. Further work was planned. Maximum values obtained: 150ppm Cu, 216ppm Zn, 70.8ppm Pb, 62ppb Au, 23.8% Fe.

Heavy mineral stream sediment sampling for diamonds was undertaken. The results did obtain rare kimberlitic compositions but it was considered that the Cretaceous cover is a possible source and no further exploration for diamonds would be entered upon.

CR1993-0196: Stockdale Prospecting Licence investigated the moderately anomalous base metal values and occurrences of particulate barite, galena and gold. The area of interest is underlain by Roper Group Sediments.

Results indicated the possibility of Pb, Zn, Cu, Ba mineralisation related to the Corcoran Formation and elevated Ag values in two areas were located. Max relevant results: 42.1% Fe, 86ppm Cu, 124ppm Zn, 0.93ppm Ag, 50.9ppm Pb. Further exploration was recommended.

CR1993-0290: Stockdale Prospecting Ltd explored for diamonds with stream sediment analyse for kimberlitic indicator minerals and Cr, Mn, Fe, Ni, Cu, Zn, As, Mo, SB, Pb, Bi undertaken. License relinquished because kimberlitic minerals were believed to be derived from a secondary source in Cretaceous sediments. Geochemical data was reviewed, but no significantly anomalous results were recorded.
CR1994-0306: Normandy Exploration undertook exploration for shale-hosted Zn-Pb-Ag deposits. However, no field work has been carried out on the tenement and work was limited to a re-evaluation of the stream assay data collected by Stockdale Prospecting Ltd by Normandy’s chief geochemist. It was determined that there are “strong correlations between Ni, Cu, Zn, Mo and lesser correlations with As, Sb, Pb and Au.....The location of NNW trending anomaly stands out from the data set....enhanced samples all lie on a major north flowing river system with total catchment well in excess of 100km². High values are conspicuously absent in the tributary drainages.....the area underlain by the Upper Roper Group as well as the lower members of the Maiwok Subgroup, in particular to black shales of the Velkerri Formation. Lower Cretaceous sandstones cap the interfluves to the east and west, and are a significant dilutant to the drainage geochemistry”.

CR1994-0440: Normandy Exploration & Stockdale Prospecting Ltd in a joint venture searched for diamonds and base metals. Stream sediment (including BLEG) and rock chip sampling was undertaken but no anomalous geochemical results were obtained. Possible kimberlitic indicator minerals recovered interpreted as being released from Cretaceous sediment (not from proximal kimberlitic source rock). This area of tenement explored was relinquished.

CR1995-0226: Normandy Exploration in their exploration for shale-hosted Zn-Pb-Ag deposits undertook percussion drilling, stream sediment, soil and rock chip analysis. Stream sediment, soil and rock chip sampling confirmed elevated base metal results from 1991 sampling programme. Percussion drilling was undertaken to obtain an overview of the stratigraphy and test the Velkerri Formation, a shale-siltstone unit. Drilling highlighted broad zones of moderate anomalism (max 420ppm Cu, 115ppm Pb and 1450ppm Zn). Elevated base metal results generally occur in carbonaceous shale/siltstone units associated with fine grained disseminated pyrite. Further drill testing of the Velkerri Formation was recommended.

CR1995-0371: Normandy Exploration carried exploration for diamonds, Zn, Ag and Pb, with the focus on sediment-hosted base metal mineralisation. No anomalous results in stream and rock-chips for the analysed geochemistry (Ni, Cu, Zn, Pb, Au) for stream and rock-chips was obtained hence, no further work was recommended.

CR1996-0348: Normandy Exploration undertook a compilation of all stream, soil and rock chip analysis done in the past to target diamond hole locations. Nine shallow (approx. 60m) percussion holes were drilled and intersected black and grey shales containing minor pyrite. Elevated Cu, Pb and Zn were obtained however these were considered to reflect background values in the Mid Velkerri Formation.

Location: Covering central south-western portion of EL 29464 and outside area to SW.  
Stockdale Prospecting Limited undertook exploration for diamonds. In 1990, heavy mineral analyse was carried out on stream and soil samples. The chromites were determined to be of moderate to low compositional interest and ilmenites to be non-kimberlitic. One sample contained 2 kimberlitic garnets, a high interest chromite and a low interest kimberlitic ilmenite. From these results, follow up stream sediment, loam and rock sampling to selected positive grains was carried out in 1991. Ilmenites proved to be non-kimberlitic. Chromites of moderate to low interest compositions found. One kimberlitic garnet was recovered. Overall, the follow up work failed to recover any further indicators and the area was partially relinquished.
Location: Covering central north-western portion of EL 29464 and outside area to W. Stockdale Prospecting Limited undertook exploration for diamonds. In 1990, heavy mineral analysis was carried out on stream and soil samples. Two high interest chromites, non-kimberlitic ilmenites, kimberlitic garnets from two samples and a singleton diamond were found. From these results, follow up stream sediment, loam and rock sampling to selected positive grains was carried out in 1991. However, ilmenites proved to be non-kimberlitic. Chromites of moderate to low interest compositions and one chromite of high interest were found. Overall, the follow up work failed to recover any further indicators and the area was partially relinquished.

Location: Covering the western portion of EL29464, and outside area to West. Stockdale Prospecting Limited undertook exploration for diamonds in EL4866 along with five other exploration licences. Exploration for the year ending 1986 included stream, loam and bulk sampling, however the results are not detailed in the report. CR1987-0128 and CR1988-0127: Exploration consisted of follow-up sampling of the above work but failed to recover any more diamonds or kimberlitic indicator minerals. Diamond and garnet previously discovered are considered to be derived from a secondary source such as the Cambrian Bukalara Sandstone or the thin Cretaceous sediments. Spinel recovered thought to derive from the Cambrian Nutwood Downs Volcanics. The area was relinquished.

EL 4545: CR1985-0192, CR1986-0167
Location: Covering the eastern portion of EL29464, and outside area to East. CRA Exploration Pty explored for diamonds. In the first year of exploration drainage gravel sampling and heavy mineral analyses was carried out. Follow up work for the following year resulted in the location of a single picroilmenite grain from the central portion of the licence area (upper reaches of an Arnold River Tributary). Single microdiamonds were reported in two samples from a site downstream of the picroilmenite sample. Follow up helicopter supported drainage sampling only gave negative results. It was concluded that tenement not prospective from kimberlitic diatremes and the area was relinquished.

EL 4546: CR1985-0179
Location: Same as EL4866. Covering the western portion of EL29464, and outside area to West. CRA Exploration Pty undertook a drainage sampling survey in their exploration for diamonds. Chromite grains were reported in 10 samples from Hodgson River Tributaries mostly from the west and centre-south portions of the licence area. No other kimberlitic indicators were detected and the area was relinquished.

EL 4477: CR1985-0149
Location: Covering the most northern portion of EL29464, and outside area to north. Stockdale Prospecting Pty undertook reconnaissance stream sediment sampling in the exploration for diamonds. Kimberlitic indicator minerals were carried out at a density of approximately 1:201km². Sample results were all negative, and the area was relinquished.

EL 3362: CR1983-0060
Location: Covering the northern half of EL29464 and outside area to the north. Ashton Mining Ltd carried out a regional gravel sampling (117 samples) programme in the exploration for diamonds and examined for heavy mineral fractions. No indicator minerals were found. The area was relinquished.
EL 3357: CR1983-0057
Location: Covering the southern half of EL29464 and outside area to south.
Ashton Mining Ltd carried out a regional gravel sampling (89 samples) programme and examined for heavy mineral fractions in the exploration for diamonds. No indicator minerals were found and the area was relinquished.

From this work:
- The majority of previous exploration concentrated in locating diamonds (kimberlitic pipes).
- Kimberlitic indicator minerals were found but generally assumed to be released from Cretaceous sediments and not from proximal kimberlitic sources.
- Exploration for shale hosted Zn-Pb-Ag deposits was also undertaken focussing mainly on the Velkerri Formation of the Roper Group. Most recently, exploration for uranium deposits of varying genetic styles and Ni-Cu-PGE sulphides was undertaken.
6. SPECTRUM EXPLORATION

6.1. Exploration during Year 1 (2013)

Administration and Office Studies

A thorough literature review of mineral exploration reports from previous tenure within EL29464 was done by Spectrum during Year 1. This study is summarised in the previous part of the report. Three major informations were taken from this work:

- The majority of previous exploration concentrated in locating diamonds (kimberlitic pipes).
- Kimberlitic indicator minerals were found but generally assumed to be released from Cretaceous sediments and not from proximal kimberlitic sources.
- Exploration for shale hosted Zn-Pb-Ag deposits was also undertaken focussing mainly on the Velkerri Formation of the Roper Group. Most recently, exploration for uranium deposits of varying genetic styles and Ni-Cu-PGE sulphides was undertaken.

Geochemical Activities

Rock chip and soil samples were taken during a helicopter supported reconnaissance program undertook by Spectrum Rare Earths in 2012 under the Miners Right agreement before the EL was granted but after pegging. 9 samples (3 soils and 6 rocks) were taken in the eastern part of the tenement (Figure 5). Assay results are attached to this report in Appendix A.

<table>
<thead>
<tr>
<th>Sample ID</th>
<th>Sample Type</th>
<th>TREO ppm</th>
<th>Dy2O3 %</th>
<th>Nd2O3 %</th>
<th>Pr6O11 %</th>
<th>Tb4O7 %</th>
<th>Sm3O3 %</th>
<th>Gd2O3 %</th>
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<td>ROCK</td>
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<td>1.01</td>
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<td>430.20</td>
<td>1.33</td>
<td>13.56</td>
<td>4.49</td>
<td>0.27</td>
<td>2.02</td>
<td>1.61</td>
<td>0.40</td>
<td>9.15</td>
<td>13.28</td>
</tr>
</tbody>
</table>
Figure 5: Surface samples location with radiometric map underlying
7. REFERENCES

Department of Natural Development, Bureau of Mineral Resources, Geology and Geophysics.


8. APPENDIX A: Exploration Data

Files include:
  • SpectrumSamples_EL29464