

Partial Relinquishment Report

EL 5321 - Meribah

Author: Chris Daniel
September 2018
(From 356km² to 300km²)

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Summary

Murray Zircon reviewed the available drilling within the relinquished portion of the tenement, and combined with the work they had conducted in drilling, assaying and geological interpretation in areas adjacent to the relinquished portion of the tenement, assessed it as not viable to host economic accumulations of heavy mineral sands.

The existing drilling on the relinquished portion was conducted by Australian Zircon and included 15 holes for 301m's. The drilling was primarily conducted along road verges, and was completed during the period 1997 to 2011.

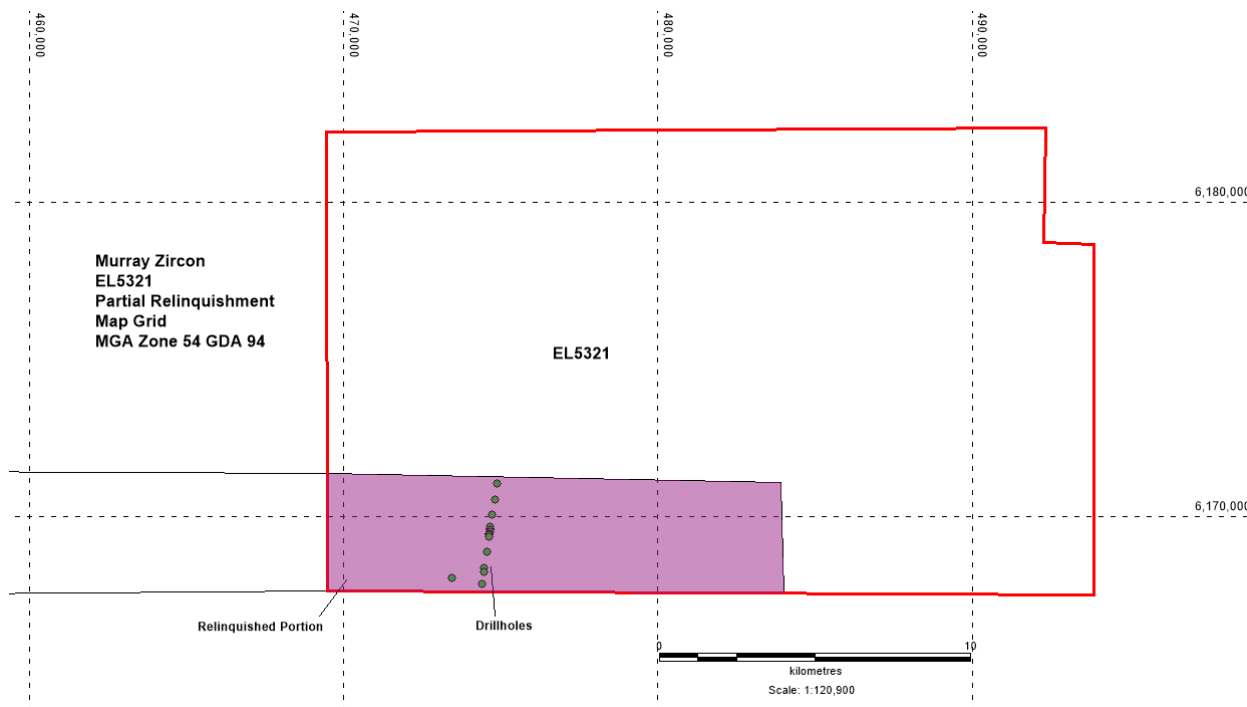


Figure 1; Exploration Index map

Keywords

Heavy mineral sand, zircon, rutile, ilmenite, aircore drilling, Loxton-Parilla Sands, Murray Basin, Tertiary.

Location and Access

The tenement lies in the Murray Mallee of South Australia, approximately 150km ENE of Murray Bridge. Access via bitumen roads can be made along the Stott Highway, which runs between Swan Reach and Loxton, and transects the southern portion of the EL.

Tenement Details

EL5321, Meribah, was granted to Murray Zircon on 02 Sept 2013. It was previously EL4182, EL3103 and EL2477.

Geology

Regional Geology.

The Murray Basin is a low lying, saucer shaped, intracratonic basin composed of Cainozoic marine and terrestrial sediments. It is located in Southeastern Australia, covering an area of approximately 300,000 km² and encompassing parts of Southeastern South Australia, north western Victoria and southwestern New South Wales.

The boundary of the basin is formed by Proterozoic basement rocks in the north-west and Proterozoic and Lower Palaeozoic rocks of the Mount Lofty and South Flinders Ranges to the west. To the south and east it is bounded by various suites of Palaeozoic sediments and metamorphic rocks which form the Lachlan Fold Belt in the Eastern and Victorian Highlands. The northern boundary is formed by Devonian to Lower Carboniferous Sediments of the Darling Basin.

The Cainozoic sediments of the Murray basin can be divided into at least three major Tertiary depositional sequences overlain by Quaternary-Recent sediments. The third, and last, Tertiary sequence consists of transgressive/regressive marine and fluvio-lacustrine clastic sediments formed in the Upper Miocene to Pliocene and is the host sequence for the mineral sands deposits of the Murray Basin. The oldest of sediments in the sequence are the Late Miocene Bookpurnong Beds, which unconformably overlie clays and limestones of the Oligocene to Middle Miocene Murray Group. They are described as poorly consolidated to plastic greenish-grey or brown calcareous clays, silt and minor sand. These are interpreted as shallow marine to lower shoreface facies of the Late Miocene to Early Pliocene marine transgression. Conformably overlying the Bookpurnong Beds is the marginal marine Loxton-Parilla Sand, which is the host unit for the heavy mineral deposits.

The Loxton-Parilla Sand consists of a series of transgressive to regressive marine sediments deposited in a range of environments from offshore (shelf?) to shallow marine and beach/strandplain. This marine sequence is locally intercalated with fluvial and lacustrine sediments that appear to be contemporaneous with the formation. Sediments vary from basal coarse sands through micaceous clays, silts, silty sands and sandy silt to cross-bedded micaceous sand with minor sandy conglomerate and pebble conglomerate. In the north and east of the basin a series of non-marine sediments is defined known as the Calivil and Shepparton Formations. These interfinger with the Bokpurnong Beds and the Loxton Parilla Sands and are interpreted as facies equivalents of the marine units. The Loxton-Parilla Sand is disconformably overlain by a sequence of non-marine sediments formed from the late Pliocene to Recent. The unconformity is often marked by a weathering profile, which is locally siliceous or lateritic and termed the Karoonda Surface.

In the central parts of the basin it is overlain by the Blanchetown Clay, which consists of greenish grey, red-brown or variegated, silty to sandy clays. It is interpreted as a fluvio-lacustrine deposit with most sedimentation taking place in a large freshwater lake. Age determinations suggest a 2.4 Ma age for the oldest parts to less than 0.7 Ma at its youngest. Disconformably overlying the Blanchetown Clays is the Quaternary Woorinen Formation. This formation is described as consisting of "red-brown siliceous silty sand, red calcareous silty clay and sandy clay". It is generally 2-3m thick, but contains east-west longitudinal dunes, which can locally be considerably thicker. The Woorinen Formation was deposited in an aeolian environment with the clay and silt sediments interpreted as being formed by a process of deflation in the swales. It is often underlain by a calcrete formation which forms locally massive, resistant sheets. These formations are known as either the Bakara Formation or the Ripon Calcrete and are particularly common in South Australia. The Woorinen also disconformably overlies the Parilla Sands in the western areas of the basin and fluvial sediments of the Shepparton Formation in eastern areas.

Brown and Stephenson (1991)

Exploration Completed

Murray Zircon Exploration

Murray Zircon reviewed the available drilling in the area and combined with work it conducted in drilling, assaying and geological interpretation in areas adjacent to the relinquished portion, deemed it unlikely to host heavy mineral sands accumulations of economic significance.

Previous Work

Australian Zircon, prior to 2011, completed 15 holes for 301m's, in the relinquished area, details of which are attached in the appendices here.

Drilling

The drilling method employed was reverse-circulation air-core drilling. This method uses hollow rods containing an inner tube which sits inside the hollow outer rod barrel. The drill cuttings are removed by injection of compressed air into the hole via the annular area between the inner tube and the drill rod. The cuttings are then blown back to surface up the inner tube where they pass through the sample separating system (cyclone, with a rotary splitter) and are collected.

Drill hole locations were set out with a handheld GPS and conducted along road verges.

Holes were backfilled on completion with drill cuttings and capped near the surface, the final 0.3m of fill consisted of native soil and a soil mound was left over the holes position to allow for any subsidence. The drill site was rehabilitated before moving to the next site, and left so as to ensure no negative visual impact remains at the site.

Geological Logging

Samples were taken for 1m intervals down the hole. Samples were caught in a calico bag held beneath the sample cyclone as a sample splitter rotated above it to provide a representative sub-sample of the 1m interval. This sub-sample was then made available to the field crew for panning.

Panning of a small handful of the sample was then undertaken to establish a lithological description and an estimate of the heavy mineral content. Observations for each sample were logged electronically into an excel spreadsheet via a ruggedized laptop computer. The data was validated upon entry. Logged data included the following visual observations and estimates;

- Dry sand colour, • Lithology, • Dominant grainsize,
- Coarse end-member grainsize, • Estimated heavy mineral content.

HM Assay

Selected samples containing anomalous HM% estimates were made available for assay, and proceeded though the assay process to provide an assay of % HM, % Oversize (OS) and % Slimes (<45um), and in some instances (<63um).

Conclusions

No significant heavy mineral occurrences were identified in a review of the drilling conducted by Australian Zircon on the portion of EL5321 relinquished. No drilling was conducted by Murray Zircon on the portion of EL5321 which has been relinquished. The portion of the tenement relinquished is not considered prospective for economic accumulations of heavy minerals.

References

Brown, C.M. & Stephenson, A.E. (1991). Geology of the Murray Basin, southeastern Australia. Bureau of Mineral Resources, Geology and Geophysics, Australia. Bulletin 235:430pp.

Appendices

Appendix 1 - Drill Hole Locations

- Included in the attached, file name [EL5321_PR_a_Drill_Collars.txt]

Appendix 2 - Geology Logs

- Included in the attached, file name [EL5321_PR_a_GeolAss.txt]

Appendix 3 - Assay Data

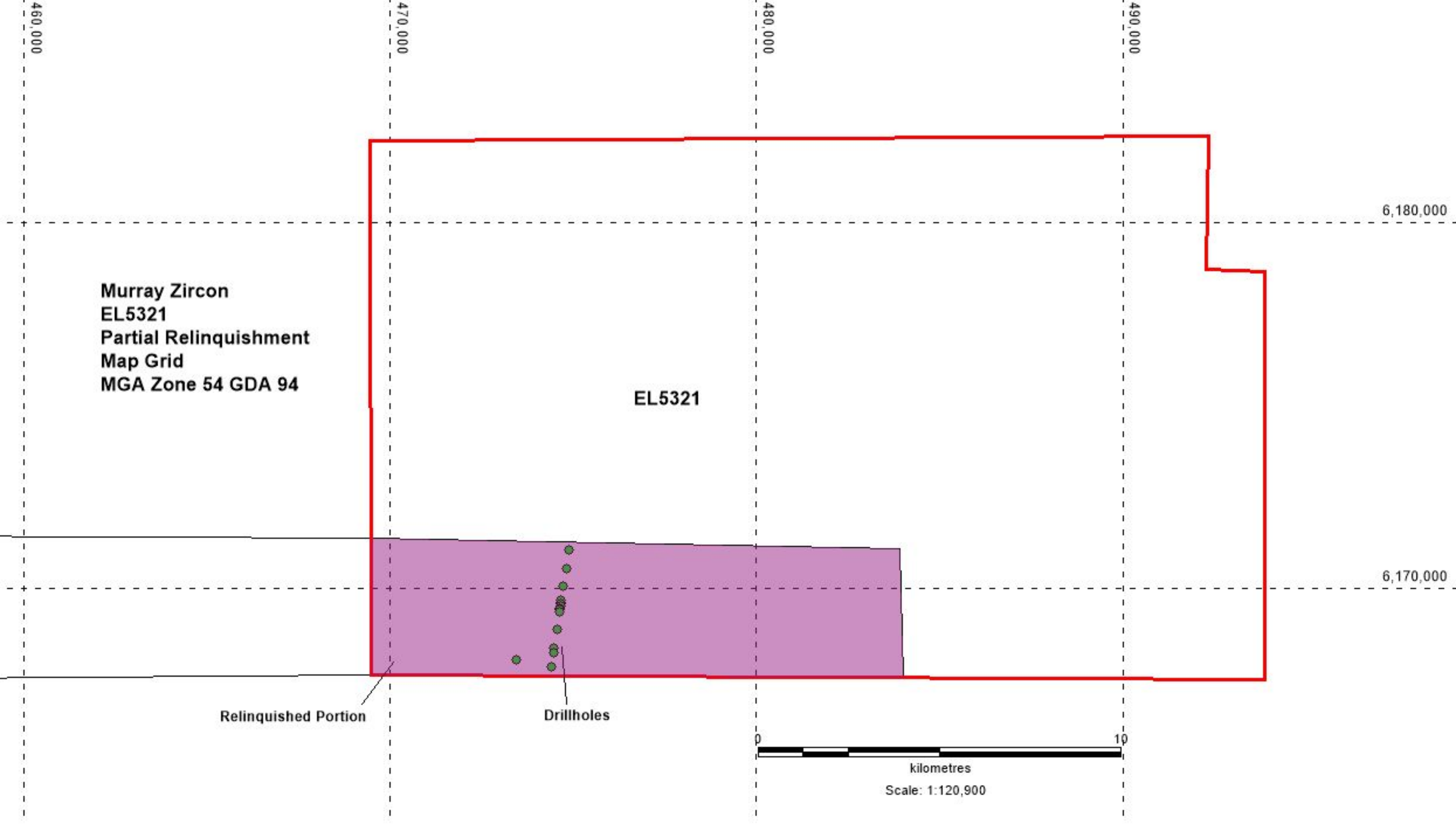
- Included in the attached, file name [EL5321_PR_a_GeolAss.txt]

Appendix 4 - Logging Codes

- Included in the attached, file name [EL5321_PR_a_Logging_Codes.txt]

Appendix 5 - Drill Hole Location Plan

Included in the attached, file name [EL5321_PR_Drill_Collar_Locn_Plan.jpg]



Partial Relinquishment Report

EL 5357 - Halidon

Author: Chris Daniel
September 2018
(From 1353km² to 913km²)

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Summary

Murray Zircon reviewed the available drilling within the relinquished portion of the tenement, and combined with the work they had conducted in drilling, assaying and geological interpretation within the relinquished portion and in areas adjacent to the tenement, assessed it as not viable to host economic accumulations of heavy mineral sands.

The existing drilling on the relinquished portion was conducted by Australian Zircon between 1997 and 2011 (which includes 312 holes for 5,485m's) and Murray Zircon in 2013 (which includes 31 holes for 1,161m's). The drilling was primarily conducted along road verges.

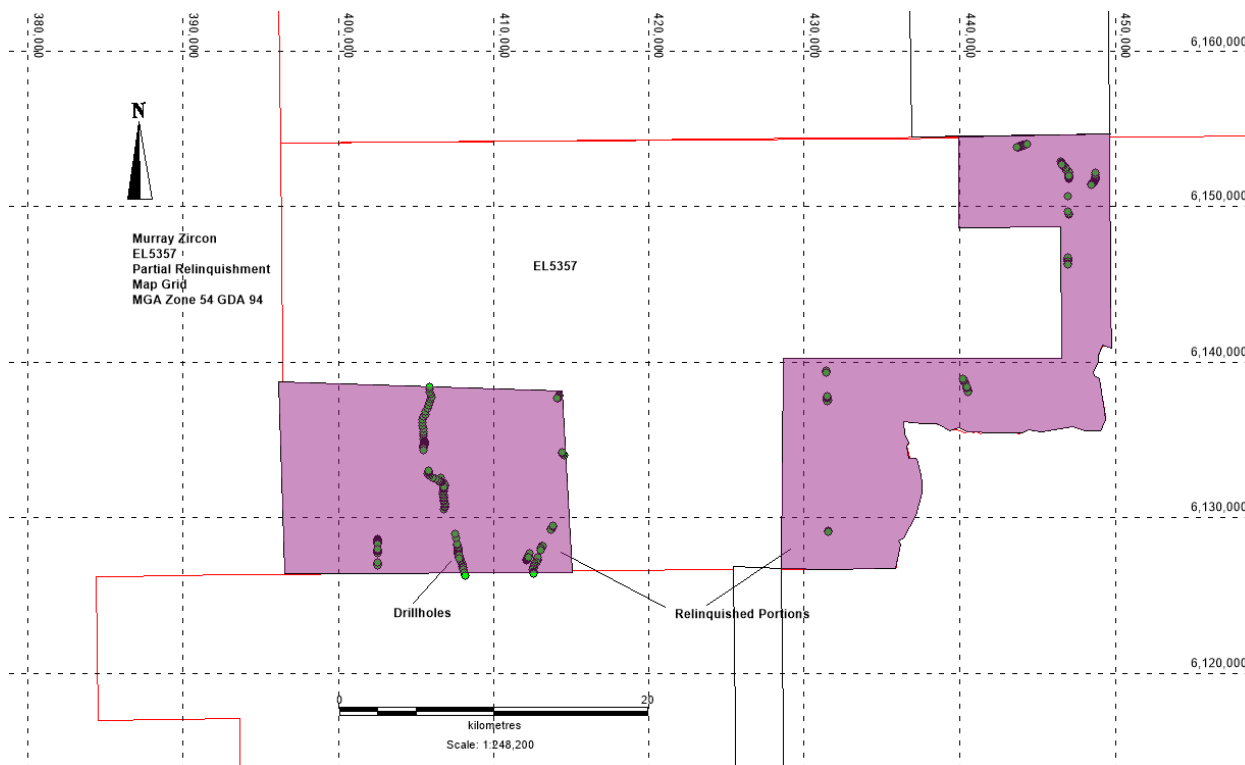


Figure 1; Exploration Index map

Keywords

Heavy mineral sand, zircon, rutile, ilmenite, aircore drilling, Loxton-Parilla Sands, Murray Basin, Tertiary.

Location and Access

The tenement lies in the Murray Mallee of South Australia, approximately 130km E of Adelaide. Access via bitumen roads can be made along the Stott Highway, which runs between Swan Reach and Loxton, and transects the southern portion of the EL.

Tenement Details

EL5357, Halidon, was granted to Murray Zircon on 02 Jan 2013. It was previously EL4017, EL3041 and EL2439.

Geology

Regional Geology.

The Murray Basin is a low lying, saucer shaped, intracratonic basin composed of Cainozoic marine and terrestrial sediments. It is located in southeastern Australia, covering an area of approximately 300,000 km² and encompassing parts of southeastern South Australia, north western Victoria and southwestern New South Wales.

The boundary of the basin is formed by Proterozoic basement rocks in the north-west and Proterozoic and Lower Palaeozoic rocks of the Mount Lofty and South Flinders Ranges to the west. To the south and east it is bounded by various suites of Palaeozoic sediments and metamorphic rocks which form the Lachlan Fold Belt in the Eastern and Victorian Highlands. The northern boundary is formed by Devonian to Lower Carboniferous Sediments of the Darling Basin.

The Cainozoic sediments of the Murray basin can be divided into at least three major Tertiary depositional sequences overlain by Quaternary-Recent sediments. The third, and last, Tertiary sequence consists of transgressive/regressive marine and fluvio-lacustrine clastic sediments formed in the Upper Miocene to Pliocene and is the host sequence for the mineral sands deposits of the Murray Basin. The oldest of sediments in the sequence are the Late Miocene Bookpurnong Beds, which unconformably overlie clays and limestones of the Oligocene to Middle Miocene Murray Group. They are described as poorly consolidated to plastic greenish-grey or brown calcareous clays, silt and minor sand. These are interpreted as shallow marine to lower shoreface facies of the Late Miocene to Early Pliocene marine transgression. Conformably overlying the Bookpurnong Beds is the marginal marine Loxton-Parilla Sand, which is the host unit for the heavy mineral deposits.

The Loxton-Parilla Sand consists of a series of transgressive to regressive marine sediments deposited in a range of environments from offshore (shelf?) to shallow marine and beach/strandplain. This marine sequence is locally intercalated with fluvial and lacustrine sediments that appear to be contemporaneous with the formation. Sediments vary from basal coarse sands through micaceous clays, silts, silty sands and sandy silt to cross-bedded micaceous sand with minor sandy conglomerate and pebble conglomerate. In the north and east of the basin a series of non-marine sediments is defined known as the Calivil and Shepparton Formations. These interfinger with the Bokpurnong Beds and the Loxton Parilla Sands and are interpreted as facies equivalents of the marine units. The Loxton-Parilla Sand is disconformably overlain by a sequence of non-marine sediments formed from the late Pliocene to Recent. The unconformity is often marked by a weathering profile, which is locally siliceous or lateritic and termed the Karoonda Surface.

In the central parts of the basin it is overlain by the Blanchetown Clay, which consists of greenish grey, red-brown or variegated, silty to sandy clays. It is interpreted as a fluvio-lacustrine deposit with most sedimentation taking place in a large freshwater lake. Age determinations suggest a 2.4 Ma age for the oldest parts to less than 0.7 Ma at its youngest. Disconformably overlying the Blanchetown Clays is the Quaternary Woorinen Formation. This formation is described as consisting of "red-brown siliceous silty sand, red calcareous silty clay and sandy clay". It is generally 2-3m thick, but contains east-west longitudinal dunes, which can locally be considerably thicker. The Woorinen Formation was deposited in an aeolian environment with the clay and silt sediments interpreted as being formed by a process of deflation in the swales. It is often underlain by a calcrete formation which forms locally massive, resistant sheets. These formations are known as either the Bakara Formation or the Ripon Calcrete and are particularly common in South Australia. The Woorinen also disconformably overlies the Parilla Sands in the western areas of the basin and fluvial sediments of the Shepparton Formation in eastern areas.

Brown and Stephenson (1991)

Exploration Completed

Murray Zircon Exploration

Murray Zircon reviewed the available drilling in the area and combined with work it conducted in drilling, assaying and geological interpretation in areas adjacent to the relinquished portion, deemed it unlikely to host heavy mineral sands accumulations of economic significance.

Previous Work

Australian Zircon, prior to 2011, completed 312 holes for 5,485m's, in the relinquished area, details of which are attached in the appendices here.

Murray Zircon in 2013 drilled 31 holes for 1161ms which are also attached in the appendices.

Drilling

The drilling method employed was reverse-circulation air-core drilling. This method uses hollow rods containing an inner tube which sits inside the hollow outer rod barrel. The drill cuttings are removed by injection of compressed air into the hole via the annular area between the inner tube and the drill rod. The cuttings are then blown back to surface up the inner tube where they pass through the sample separating system (cyclone, with a rotary splitter) and are collected.

Drill hole locations were set out with a handheld GPS and conducted along road verges.

Holes were backfilled on completion with drill cuttings and capped near the surface, the final 0.3m of fill consisted of native soil and a soil mound was left over the holes position to allow for any subsidence. The drill site was rehabilitated before moving to the next site, and left so as to ensure no negative visual impact remains at the site.

Geological Logging

Samples were taken for 1m intervals down the hole. Samples were caught in a calico bag held beneath the sample cyclone as a sample splitter rotated above it to provide a representative sub-sample of the 1m interval. This sub-sample was then made available to the field crew for panning.

Panning of a small handful of the sample was then undertaken to establish a lithological description and an estimate of the heavy mineral content. Observations for each sample were logged electronically into an excel spreadsheet via a ruggedized laptop computer. The data was validated upon entry. Logged data included the following visual observations and estimates;

- Dry sand colour, • Lithology, • Dominant grainsize,
- Coarse end-member grainsize, • Estimated heavy mineral content.

HM Assay

Selected samples containing anomalous HM% estimates were made available for assay, and proceeded though the assay process to provide an assay of % HM, % Oversize (OS) and % Slimes (<45um), and in some instances (<63um).

Conclusions

No significant heavy mineral occurrences were identified in a review of the drilling conducted by Australian Zircon and Murray Zircon on the portion of EL5357 relinquished. The portion of the tenement relinquished is not considered prospective for economic accumulations of heavy minerals.

References

Brown, C.M. & Stephenson, A.E. (1991). Geology of the Murray Basin, southeastern Australia. Bureau of Mineral Resources, Geology and Geophysics, Australia. Bulletin 235:430pp.

Appendices

Appendix 1 - Drill Hole Locations

- Included in the attached, file name [EL5357_PR_a_Drill_Collars.txt]

Appendix 2 - Geology Logs

- Included in the attached, file name [EL5357_PR_a_GeolAss.txt]
- Included in the attached, file name [EL5357_PR_b_GeolAss.txt]

Appendix 3 - Assay Data

- Included in the attached, file name [EL5357_PR_a_GeolAss.txt]
- Included in the attached, file name [EL5357_PR_b_GeolAss.txt]

Appendix 4 - Logging Codes

- Included in the attached, file name [EL5357_PR_a_Logging_Codes.txt]
- Included in the attached, file name [EL5357_PR_b_Logging_Codes.txt]

Appendix 5 - Drill Hole Location Plan

Included in the attached, file name [EL5357_PR_Drill_Collar_Locn_Plan.jpg]

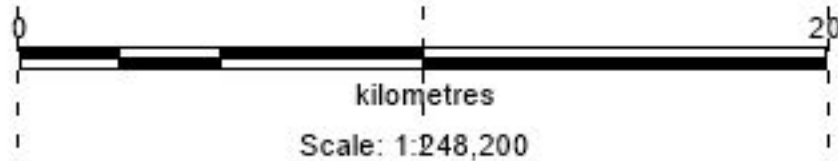


Murray Zircon
EL5357
Partial Relinquishment
Map Grid
MGA Zone 54 GDA 94

EL5357

Drillholes

Relinquished Portions



Partial Surrender Report

EL 6112 – Mantung
(From 1297km² to 995km²)

Author: Chris Daniel
September 2018

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Summary

Murray Zircon reviewed the available drilling within the relinquished portion of the tenement, and combined with the work they had conducted in drilling, assaying and geological interpretation in areas adjacent to the relinquished portion of the tenement, assessed it as not viable to host economic accumulations of heavy mineral sands.

The existing drilling on the relinquished portion was conducted by Australian Zircon and included 38 holes for 722m's. The drilling was primarily conducted along road verges, and was completed during the period 1997 to 2011.



Figure 1; Exploration Index map

Keywords

Heavy mineral sand, zircon, rutile, ilmenite, aircore drilling, Loxton-Parilla Sands, Murray Basin, Tertiary.

Location and Access

The tenement lies in the Murray Mallee of South Australia, approximately 130km E of Adelaide. Access via bitumen roads can be made along the Stott Highway, which runs between Swan Reach and Loxton, and transects the southern portion of the EL.

Tenement Details

EL6112, Mantung, was granted to Murray Zircon on 2nd Jan 2018 for a period of two years. It was previously EL5223, EL4018, EL3046 and EL2448.

Geology

Regional Geology.

The Murray Basin is a low lying, saucer shaped, intracratonic basin composed of Cainozoic marine and terrestrial sediments. It is located in southeastern Australia, covering an area of approximately 300,000 km² and encompassing parts of southeastern South Australia, north western Victoria and southwestern New South Wales.

The boundary of the basin is formed by Proterozoic basement rocks in the north-west and Proterozoic and Lower Palaeozoic rocks of the Mount Lofty and South Flinders Ranges to the west. To the south and east it is bounded by various suites of Palaeozoic sediments and metamorphic rocks which form the Lachlan Fold Belt in the Eastern and Victorian Highlands. The northern boundary is formed by Devonian to Lower Carboniferous Sediments of the Darling Basin.

The Cainozoic sediments of the Murray basin can be divided into at least three major Tertiary depositional sequences overlain by Quaternary-Recent sediments. The third, and last, Tertiary sequence consists of transgressive/regressive marine and fluvio-lacustrine clastic sediments formed in the Upper Miocene to Pliocene and is the host sequence for the mineral sands deposits of the Murray Basin. The oldest of sediments in the sequence are the Late Miocene Bookpurnong Beds, which unconformably overlie clays and limestones of the Oligocene to Middle Miocene Murray Group. They are described as poorly consolidated to plastic greenish-grey or brown calcareous clays, silt and minor sand. These are interpreted as shallow marine to lower shoreface facies of the Late Miocene to Early Pliocene marine transgression. Conformably overlying the Bookpurnong Beds is the marginal marine Loxton-Parilla Sand, which is the host unit for the heavy mineral deposits.

The Loxton-Parilla Sand consists of a series of transgressive to regressive marine sediments deposited in a range of environments from offshore (shelf?) to shallow marine and beach/strandplain. This marine sequence is locally intercalated with fluvial and lacustrine sediments that appear to be contemporaneous with the formation. Sediments vary from basal coarse sands through micaceous clays, silts, silty sands and sandy silt to cross-bedded micaceous sand with minor sandy conglomerate and pebble conglomerate. In the north and east of the basin a series of non-marine sediments is defined known as the Calivil and Shepparton Formations. These interfinger with the Bookpurnong Beds and the Loxton Parilla Sands and are interpreted as facies equivalents of the marine units. The Loxton-Parilla Sand is disconformably overlain by a sequence of non-marine sediments formed from the late Pliocene to Recent. The unconformity is often marked by a weathering profile, which is locally siliceous or lateritic and termed the Karoonda Surface.

In the central parts of the basin it is overlain by the Blanchetown Clay, which consists of greenish grey, red-brown or variegated, silty to sandy clays. It is interpreted as a fluvio-lacustrine deposit with most sedimentation taking place in a large freshwater lake. Age determinations suggest a 2.4 Ma age for the oldest parts to less than 0.7 Ma at its youngest. Disconformably overlying the Blanchetown Clays is the Quaternary Woorinen Formation. This formation is described as consisting of "red-brown siliceous silty sand, red calcareous silty clay and sandy clay". It is generally 2-3m thick, but contains east-west longitudinal dunes, which can locally be considerably thicker. The Woorinen Formation was deposited in an aeolian environment with the clay and silt sediments interpreted as being formed by a process of deflation in the swales. It is often underlain by a calcrete formation which forms locally massive, resistant sheets. These formations are known as either the Bakara Formation or the Ripon Calcrete and are particularly common in South Australia. The Woorinen also disconformably overlies the Parilla Sands in the western areas of the basin and fluvial sediments of the Shepparton Formation in eastern areas.

Brown and Stephenson (1991)

Exploration Completed

Murray Zircon Exploration

Murray Zircon reviewed the available drilling in the area and combined with work it conducted in drilling, assaying and geological interpretation in areas adjacent to the relinquished portion, deemed it unlikely to host heavy mineral sands accumulations of economic significance.

Previous Work

Australian Zircon, prior to 2011, completed 38 holes for 722m's, in the relinquished area, details of which are attached in the appendices here.

Drilling

The drilling method employed was reverse-circulation air-core drilling. This method uses hollow rods containing an inner tube which sits inside the hollow outer rod barrel. The drill cuttings are removed by injection of compressed air into the hole via the annular area between the inner tube and the drill rod. The cuttings are then blown back to surface up the inner tube where they pass through the sample separating system (cyclone, with a rotary splitter) and are collected.

Drill hole locations were set out with a handheld GPS and conducted along road verges.

Holes were backfilled on completion with drill cuttings and capped near the surface, the final 0.3m of fill consisted of native soil and a soil mound was left over the holes position to allow for any subsidence. The drill site was rehabilitated before moving to the next site, and left so as to ensure no negative visual impact remains at the site.

Geological Logging

Samples were taken for 1m intervals down the hole. Samples were caught in a calico bag held beneath the sample cyclone as a sample splitter rotated above it to provide a representative sub-sample of the 1m interval. This sub-sample was then made available to the field crew for panning.

Panning of a small handful of the sample was then undertaken to establish a lithological description and an estimate of the heavy mineral content. Observations for each sample were logged electronically into an excel spreadsheet via a ruggedized laptop computer. The data was validated upon entry. Logged data included the following visual observations and estimates;

- Dry sand colour, • Lithology, • Dominant grainsize,
- Coarse end-member grainsize, • Estimated heavy mineral content.

HM Assay

Selected samples containing anomalous HM% estimates were made available for assay, and proceeded though the assay process to provide an assay of % HM, % Oversize (OS) and % Slimes (<45um), and in some instances (<63um).

Conclusions

No significant heavy mineral occurrences were identified in a review of the drilling conducted by Australian Zircon on the portion of EL6112 relinquished. No drilling was conducted by Murray Zircon on the portion of EL6112 which has been relinquished. The portion of the tenement relinquished is not considered prospective for economic accumulations of heavy minerals.

References

Brown, C.M. & Stephenson, A.E. (1991). Geology of the Murray Basin, southeastern Australia. Bureau of Mineral Resources, Geology and Geophysics, Australia. Bulletin 235:430pp.

Appendices

Appendix 1 - Drill Hole Locations

- Included in the attached, file name [EL6112_PR_a_Drill_Collars.txt]

Appendix 2 - Geology Logs

- Included in the attached, file name [EL6112_PR_a_GeolAss.txt]

Appendix 3 - Assay Data

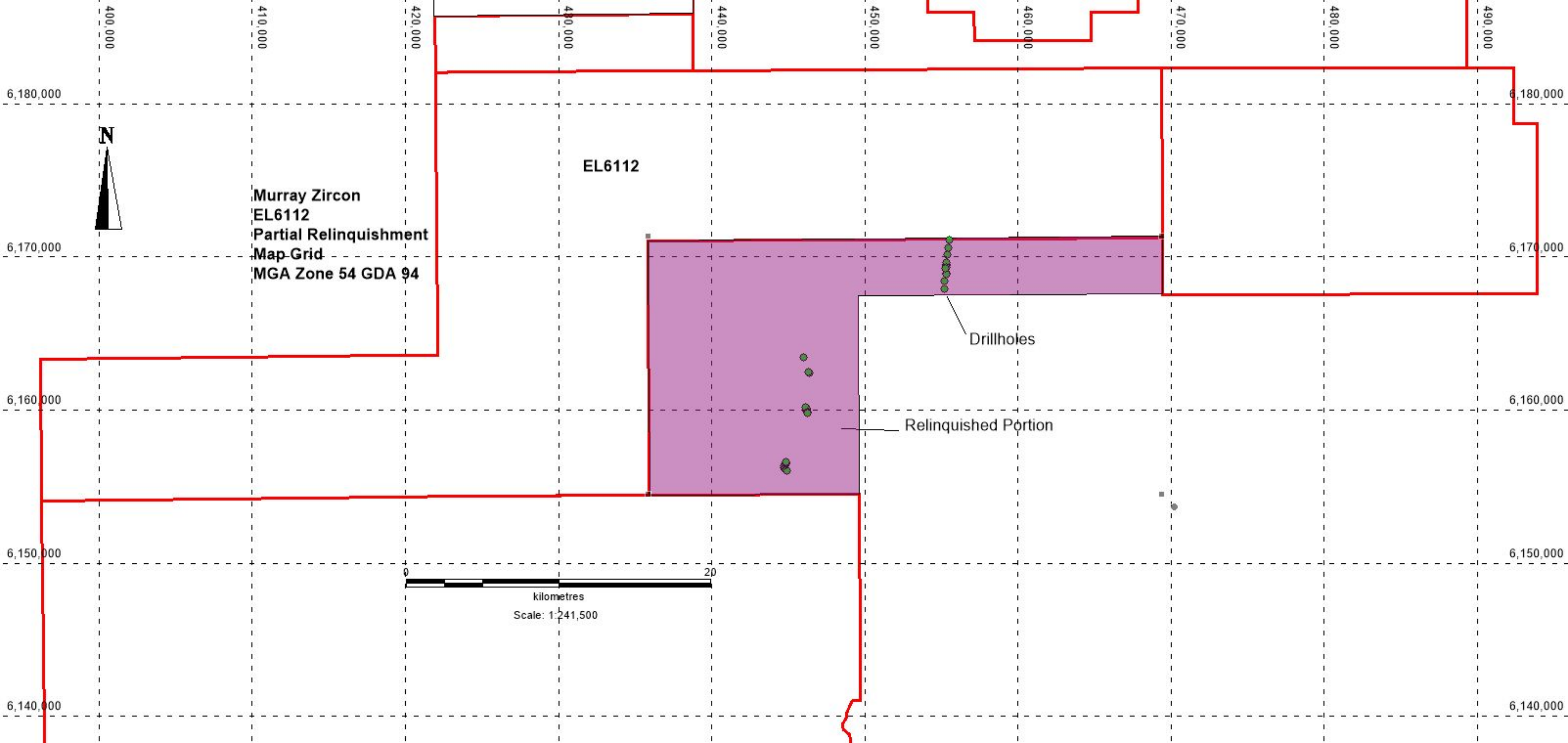
- Included in the attached, file name [EL6112_PR_a_GeolAss.txt]

Appendix 4 - Logging Codes

- Included in the attached, file name [EL6112_PR_a_Logging_Codes.txt]

Appendix 5 - Drill Hole Location Plan

Included in the attached, file name [EL6112_PR_Drill_Collar_Locn_Plan.jpg]



Partial Surrender Report

EL 6124 - Karoonda

Author: Chris Daniel
September 2018

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Summary

Murray Zircon reviewed the available drilling within the relinquished portion of the tenement, and combined with the work they had conducted in drilling, assaying and geological interpretation in areas adjacent to the relinquished portion of the tenement, assessed it as not viable to host economic accumulations of heavy mineral sands.

The existing drilling on the relinquished portion was conducted by Australian Zircon and included 88 holes for 1,910m's and was completed during the period 1997 to 2011. The drilling was primarily conducted along road verges.

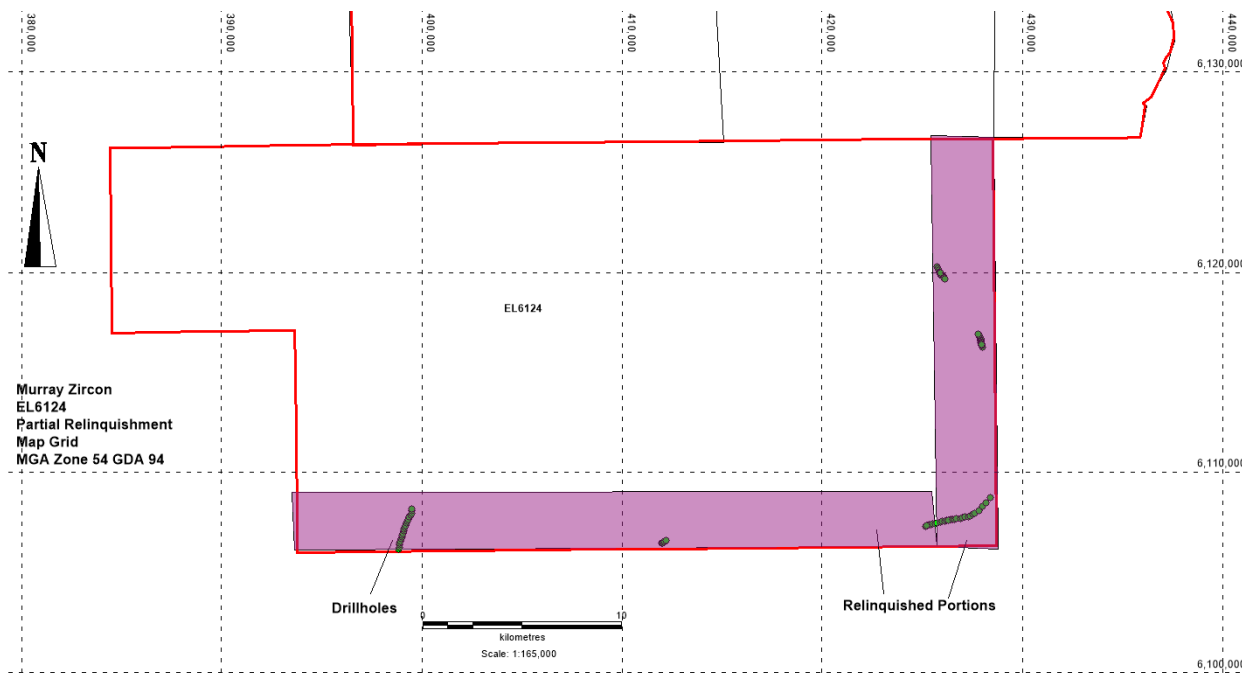


Figure 1; Exploration Index map

Keywords

Heavy mineral sand, zircon, rutile, ilmenite, aircore drilling, Loxton-Parilla Sands, Murray Basin, Tertiary.

Location and Access

The tenement lies in the Murray Mallee of South Australia, approximately 140km E of Adelaide. Access via bitumen roads can be made along the Stott Highway, which runs between Swan Reach and Loxton, and transects the southern portion of the EL.

Tenement Details

EL6124, Karoonda, was granted to Murray Zircon on 02 Jan 2018 for a period of two years. It was previously EL5222, EL4016, EL3042 and EL2438.

Geology

Regional Geology.

The Murray Basin is a low lying, saucer shaped, intracratonic basin composed of Cainozoic marine and terrestrial sediments. It is located in southeastern Australia, covering an area of approximately 300,000 km² and encompassing parts of southeastern South Australia, north western Victoria and southwestern New South Wales.

The boundary of the basin is formed by Proterozoic basement rocks in the north-west and Proterozoic and Lower Palaeozoic rocks of the Mount Lofty and South Flinders Ranges to the west. To the south and east it is bounded by various suites of Palaeozoic sediments and metamorphic rocks which form the Lachlan Fold Belt in the Eastern and Victorian Highlands. The northern boundary is formed by Devonian to Lower Carboniferous Sediments of the Darling Basin.

The Cainozoic sediments of the Murray basin can be divided into at least three major Tertiary depositional sequences overlain by Quaternary-Recent sediments. The third, and last, Tertiary sequence consists of transgressive/regressive marine and fluvio-lacustrine clastic sediments formed in the Upper Miocene to Pliocene and is the host sequence for the mineral sands deposits of the Murray Basin. The oldest of sediments in the sequence are the Late Miocene Bookpurnong Beds, which unconformably overlie clays and limestones of the Oligocene to Middle Miocene Murray Group. They are described as poorly consolidated to plastic greenish-grey or brown calcareous clays, silt and minor sand. These are interpreted as shallow marine to lower shoreface facies of the Late Miocene to Early Pliocene marine transgression. Conformably overlying the Bookpurnong Beds is the marginal marine Loxton-Parilla Sand, which is the host unit for the heavy mineral deposits.

The Loxton-Parilla Sand consists of a series of transgressive to regressive marine sediments deposited in a range of environments from offshore (shelf?) to shallow marine and beach/strandplain. This marine sequence is locally intercalated with fluvial and lacustrine sediments that appear to be contemporaneous with the formation. Sediments vary from basal coarse sands through micaceous clays, silts, silty sands and sandy silt to cross-bedded micaceous sand with minor sandy conglomerate and pebble conglomerate. In the north and east of the basin a series of non-marine sediments is defined known as the Calivil and Shepparton Formations. These interfinger with the Bokpurnong Beds and the Loxton Parilla Sands and are interpreted as facies equivalents of the marine units. The Loxton-Parilla Sand is disconformably overlain by a sequence of non-marine sediments formed from the late Pliocene to Recent. The unconformity is often marked by a weathering profile, which is locally siliceous or lateritic and termed the Karoonda Surface.

In the central parts of the basin it is overlain by the Blanchetown Clay, which consists of greenish grey, red-brown or variegated, silty to sandy clays. It is interpreted as a fluvio-lacustrine deposit with most sedimentation taking place in a large freshwater lake. Age determinations suggest a 2.4 Ma age for the oldest parts to less than 0.7 Ma at its youngest. Disconformably overlying the Blanchetown Clays is the Quaternary Woorinen Formation. This formation is described as consisting of "red-brown siliceous silty sand, red calcareous silty clay and sandy clay". It is generally 2-3m thick, but contains east-west longitudinal dunes, which can locally be considerably thicker. The Woorinen Formation was deposited in an aeolian environment with the clay and silt sediments interpreted as being formed by a process of deflation in the swales. It is often underlain by a calcrete formation which forms locally massive, resistant sheets. These formations are known as either the Bakara Formation or the Ripon Calcrete and are particularly common in South Australia. The Woorinen also disconformably overlies the Parilla Sands in the western areas of the basin and fluvial sediments of the Shepparton Formation in eastern areas.

Brown and Stephenson (1991)

Exploration Completed

Murray Zircon Exploration

Murray Zircon reviewed the available drilling in the area and combined with work it conducted in drilling, assaying and geological interpretation in areas adjacent to the relinquished portion, deemed it unlikely to host heavy mineral sands accumulations of economic significance.

Previous Work

Australian Zircon, prior to 2011, completed 88 holes for 1,910m's, in the relinquished area, details of which are attached in the appendices here.

Drilling

The drilling method employed was reverse-circulation air-core drilling. This method uses hollow rods containing an inner tube which sits inside the hollow outer rod barrel. The drill cuttings are removed by injection of compressed air into the hole via the annular area between the inner tube and the drill rod. The cuttings are then blown back to surface up the inner tube where they pass through the sample separating system (cyclone, with a rotary splitter) and are collected.

Drill hole locations were set out with a handheld GPS and conducted along road verges.

Holes were backfilled on completion with drill cuttings and capped near the surface, the final 0.3m of fill consisted of native soil and a soil mound was left over the holes position to allow for any subsidence. The drill site was rehabilitated before moving to the next site, and left so as to ensure no negative visual impact remains at the site.

Geological Logging

Samples were taken for 1m intervals down the hole. Samples were caught in a calico bag held beneath the sample cyclone as a sample splitter rotated above it to provide a representative sub-sample of the 1m interval. This sub-sample was then made available to the field crew for panning.

Panning of a small handful of the sample was then undertaken to establish a lithological description and an estimate of the heavy mineral content. Observations for each sample were logged electronically into an excel spreadsheet via a ruggedized laptop computer. The data was validated upon entry. Logged data included the following visual observations and estimates;

- Dry sand colour, • Lithology, • Dominant grainsize,
- Coarse end-member grainsize, • Estimated heavy mineral content.

HM Assay

Selected samples containing anomalous HM% estimates were made available for assay, and proceeded though the assay process to provide an assay of % HM, % Oversize (OS) and % Slimes (<45um), and in some instances (<63um).

Conclusions

No significant heavy mineral occurrences were identified in a review of the drilling conducted by Australian Zircon on the portion of EL6124 relinquished. No drilling was conducted by Murray Zircon on the portion of EL6124 which has been relinquished. The portion of the tenement relinquished is not considered prospective for economic accumulations of heavy minerals.

References

Brown, C.M. & Stephenson, A.E. (1991). Geology of the Murray Basin, southeastern Australia. Bureau of Mineral Resources, Geology and Geophysics, Australia. Bulletin 235:430pp.

Appendices

Appendix 1 - Drill Hole Locations

- Included in the attached, file name [EL6124_PR_a_Drill_Collars.txt]

Appendix 2 - Geology Logs

- Included in the attached, file name [EL6124_PR_a_GeolAss.txt]
- Included in the attached, file name [EL6124_PR_b_GeolAss.txt]

Appendix 3 - Assay Data

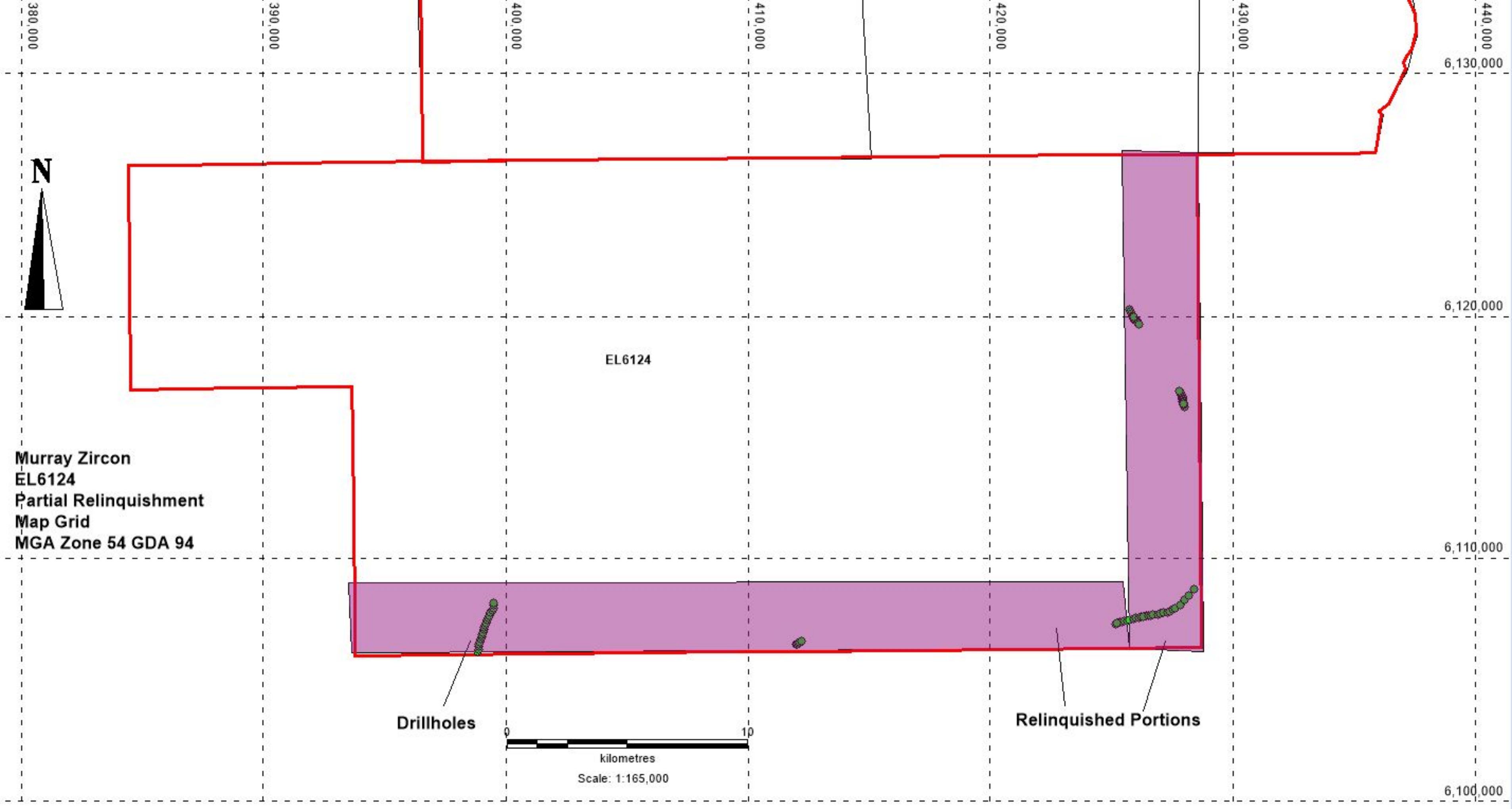
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Appendix 4 - Logging Codes

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Appendix 5 - Drill Hole Location Plan

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Partial Surrender Report

EL 6146 – Woolpunda
(From 249km² to 62km²)

Author: Chris Daniel
September 2018

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Summary

Murray Zircon reviewed the available drilling within the relinquished portion of the tenement, and combined with the work they had conducted in drilling, assaying and geological interpretation in areas adjacent to the relinquished portion of the tenement, assessed it as not viable to host economic accumulations of heavy mineral sands.

The existing drilling on the relinquished portion was conducted by Australian Zircon and included 67 holes for 1,191m's. The drilling was primarily conducted along road verges, and was completed during the period 1997 to 2011.

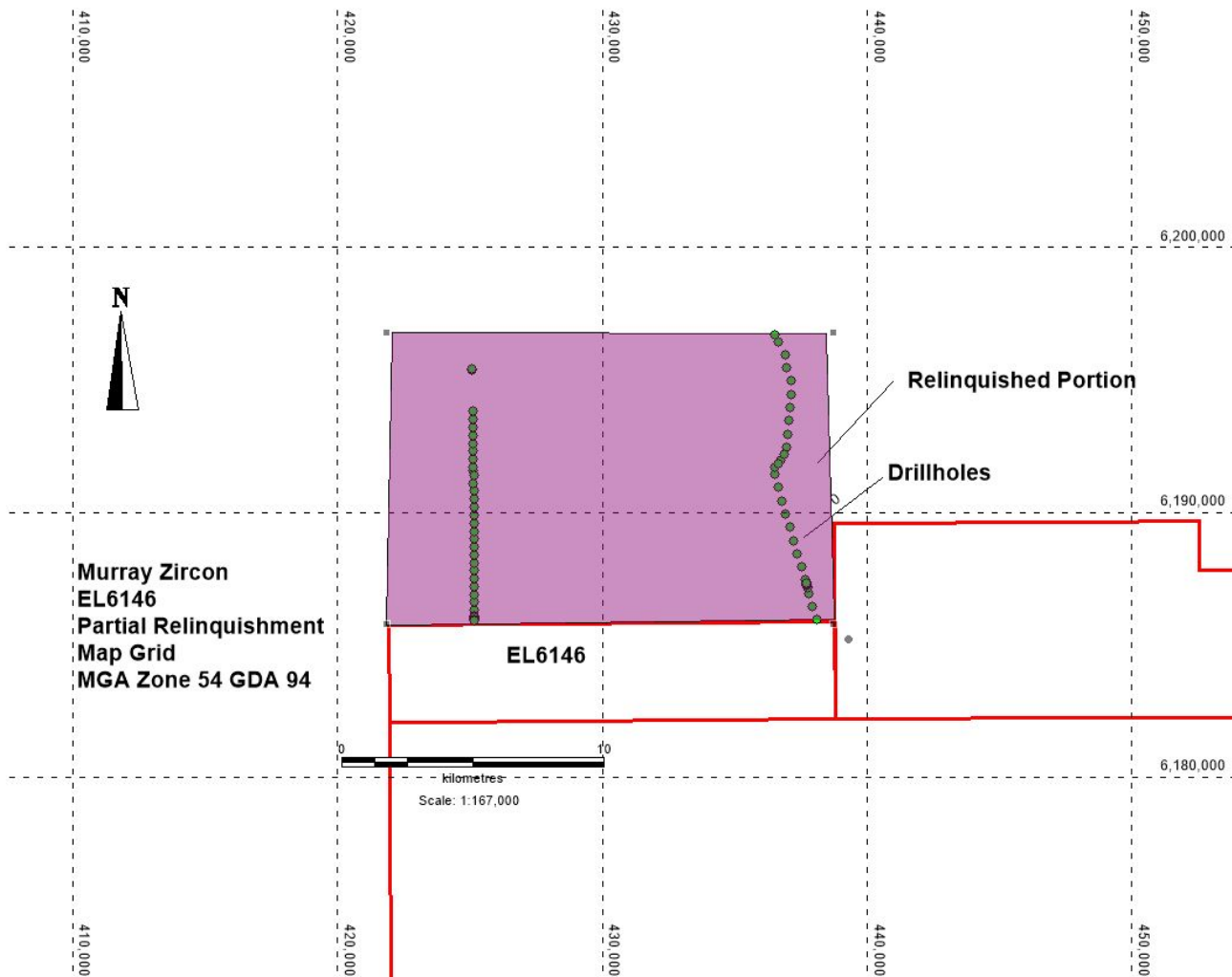


Figure 1; Exploration Index map

Keywords

Heavy mineral sand, zircon, rutile, ilmenite, aircore drilling, Loxton-Parilla Sands, Murray Basin, Tertiary.

Location and Access

The tenement lies in the Murray Mallee of South Australia, approximately 160km NE of Adelaide. Access via bitumen roads can be made along the Stott Highway, which runs between Swan Reach and Loxton, and transects the southern portion of the EL.

Tenement Details

EL6146, Woolpunda, was granted to Murray Zircon on 4th July 2017 for a period of two years. It was previously EL4947, EL3568 and EL2767.

Geology

Regional Geology.

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HM Assay

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Conclusions

No significant heavy mineral occurrences were identified in a review of the drilling conducted by Murray Zircon on the portion of EL6146 relinquished. No drilling was conducted by Murray Zircon on the portion of EL6146 which has been relinquished. The portion of the tenement relinquished is not considered prospective for economic accumulations of heavy minerals.

References

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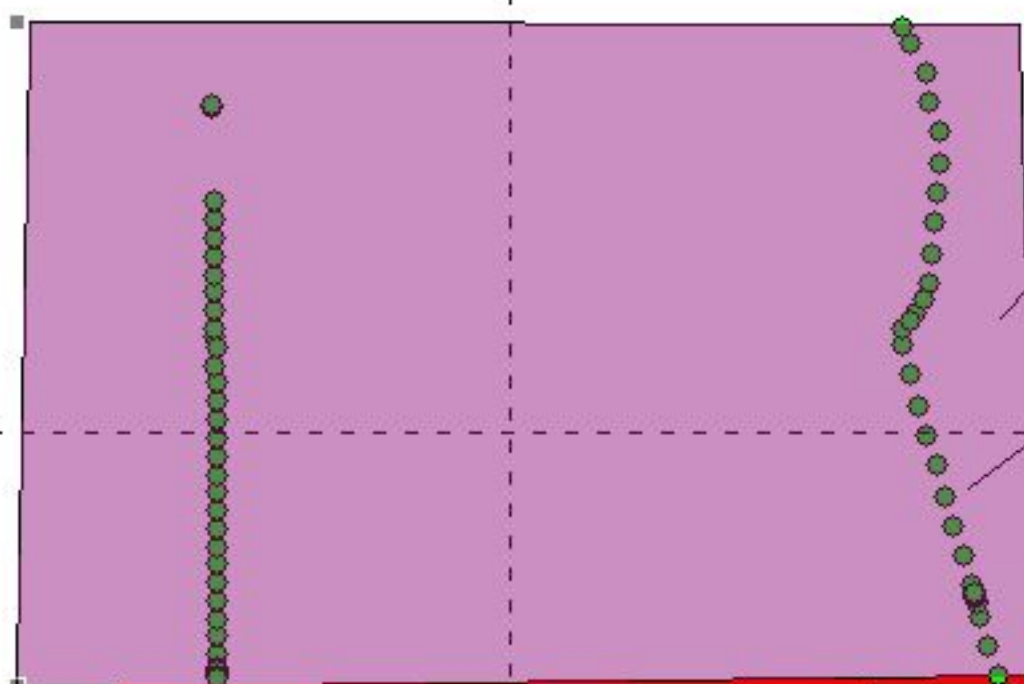
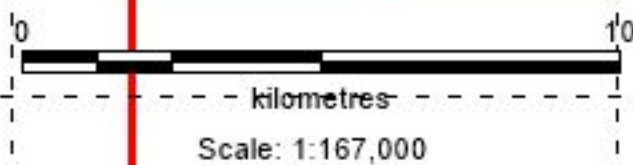
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Murray Zircon
EL6146
Partial Relinquishment
Map Grid
MGA Zone 54 GDA 94



Relinquished Portion

Drillholes

EL6146

6,200,000

6,190,000

6,180,000

410,000

420,000

430,000

440,000

450,000

410,000

420,000

430,000

440,000

450,000