Terra Tasmania Resources

2016 ANNUAL REPORT
Exploration Licence EL30/2011

Exploration Activity of
Terra Tasmania Resources Pty Ltd

Submitted pursuant to the
Mineral Resources Development Act 1995

22 December 2016

Terra Tasmania Resources

PREFACE

This Report has been prepared in accordance with the conditions outlined in Exploration Licence EL30/2011, subject to the Mineral Resources Development Act 1995 (As amended). To the best of Terra Tasmania Resources Pty Ltd ('TTR') knowledge, the report presented herein represents the intentions and work undertaken leading up to and including the time of printing of the report.

During preparation of this report TTR has relied upon data, surveys, analysis, designs, plans and other information provided by past reports, third parties, and other individuals and organisations referenced herein. Except as otherwise stated in this report, TTR has not independently verified the accuracy or completeness of all nominated data, surveys, analysis, designs, plans and additional supporting information.

Terra Tasmania Resources Pty Ltd does not accept any responsibility for use of any part of this report by third parties.

Terra Tasmania Resources Pty Ltd

PO Box 103,

Scamander, Tasmania 7302

Australia

ACN: 141 081 889

ABN: 75 141 081 889

Chairman, Dean Lisson
M: 0419 599954
E: deanlisson@tassie.net.au

Managing Director, Phillip Simpson
M: 0418 128838
E: philsimpson@bigpond.com

Date

of

Issue: 22 December 2016

CONTENTS

TTR during 2016 was restricted in the implementation of its previously stated work program due to the ongoing downward trend in global oil prices that frustrated capital raising efforts.

Fruitful discussions with a European funding group in conjunction with Terra Energy and Resources Technologies Inc. and its technology arm, Terrain Insight Services Inc., has resulted in Terra Insight Services using the Play Based Exploration work of Petrogeos (Dr. Andre Coffa) to refine its remote sensing satellite technology to further identify prospects and leads on EL30/2011.

During the last quarter 2016, Terrain Insight Services Inc. ('TIS') received Tranche 1 of $205,000 to ramp up the evaluation of EL30 using remote sensing satellite interpretation. The regional survey of the entire acreage has highlighted areas of interest that correlate with Dr. Coffa's Play Based findings. TIS has been wired Tranche 2 of $197,000 to continue the satellite evaluation that will refine the areas of interest, with a view to ultimately drilling the highest priority targets. Recent success drilling in the USA (October – November – December) in Louisiana and Bridge County, Texas where commercial gas was discovered at the predicted depth in both cases, has given the funders confidence to allocate the financial resources required for a Tasmanian drilling campaign.

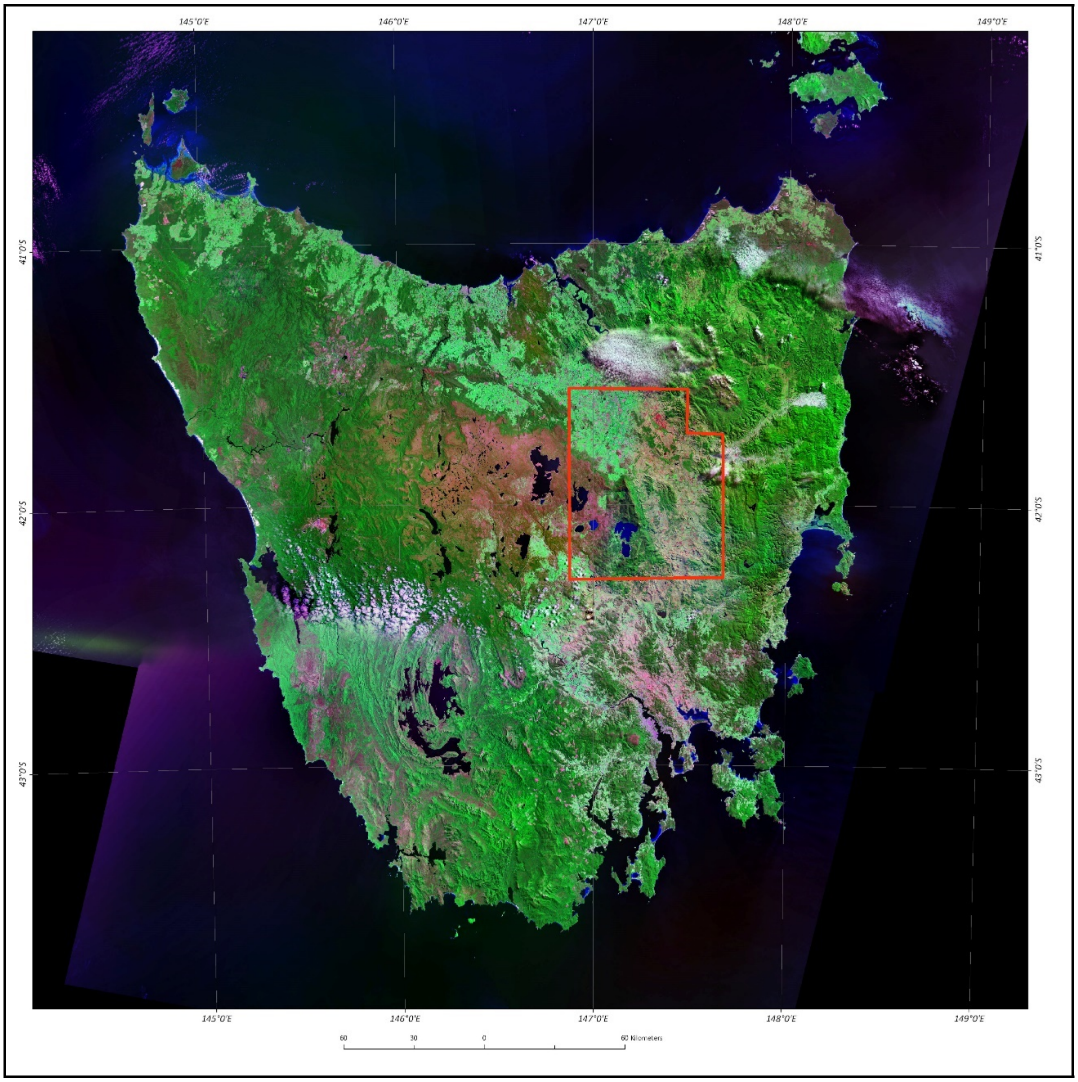
TTR has concentrated its efforts during 2016 on cementing its relationship with Terra Energy Resource Technologies Inc and it Joint Venture partners from Europe and ramping up its exploration activities, now that funds are secured.

In furthering the Play Based findings of Dr. Coffas and Petrogeos Consulting and as per his recommendations in the 2015 Annual Report, TTR determined to use the subterranean remote sensing STeP satellite technology to supplement the work already done over EL30 and solidify the hydrocarbon plays and prospects.

A full evaluation of EL30 by Step has been funded now at a cost of $1,428,000 that will lead to a 3D seismic program and use of additional Terra technologies to refine the highest priority drilling targets in early 2018 with the aim to drill at least 3 targets as full sized exploration wells. A full suite of down-hole testing equipment will be used for each well.

Terra Tasmania Resources

Geoscience Report on the Prospectivity of Petroleum Licence EL30/2011 Tasmania



TERRA TASMANIA RESOURCES (EL30/2011)

Terra Insight Services, Inc.

Date Submitted: 22/12/2016

1. EXECUTIVE SUMMARY AND RECOMMENDATIONS

1.1 REFERENCE TO TTR ANNUAL REPORT 2015

The 2015 report concluded the following (quoted from the 2015 report):

1. EL30/2011 has significant exploration potential, in part due to hydrocarbon seeps within and around the licence, but also hydrocarbon indicators in previously drilled holes within the licence area. This licence has the capacity to open up new plays in the Tasmania Basin, in which there are two main geological systems identified as having significant potential for hydrocarbons. These are the Larapintine System (Ordovician and Silurian) and the Gondwana System (Permian).
2. Using past reports and scientific papers, the team conducted a Play based Exploration exercise to suggest more and less prospective areas around the Tasmania Basin. Hydrocarbon system elements were investigated for each play and used to make convolved play "sweet-spot" maps. The resulting maps display that there are areas of relatively good prospectivity within EL30/2011 in both main plays.
3. The licence has significant exploration potential because all hydrocarbon system elements are present. There is a working petroleum system as several seeps have been discovered, the most significant being the Lonnavale Seep. Analysis of 2 samples (bitumen and liquid) confirmed a Tasmanite-bearing source. Stratigraphic wells and seismic lines provide evidence for effective reservoirs, traps and seals.
4. Recommendations and Conclusions
   The Play Based Exploration project and investigation results obtained thus far by Petrogeos Consultants are the initial steps. Before any area can be thoroughly assessed the play-based exploration methodology must be based on original well data, gravity magnetic maps, seismic and field based surveys. This work has demonstrated the potential in poorly understood areas. *Now work can continue by highlighting areas based on existing and new data.* *Leads and prospects can then be ranked and risked to determine reasonable drill locations.*

1.2 METHODOLOGY USED TO CONTINUE WORK IN 2016

Based on the work carried out in 2015 and its recommendations, STeP survey was selected to "highlight areas based on…new data", so that "leads and prospects can then be ranked."

Dating back to 2011, the original TTR work program entailed STeP® survey conducted by Terra Insight Services, Inc. (www.terrainsight.com) and was accepted by MRT. TTR has reverted to the STeP survey as a part of the play-based approach in order to elevate the value of all of the geological research and use STeP as an additional input as a part of the approach and in order to better high-grade the Area of Interest (AOI or EL30/2011) into zones of prospectivity.

In 2016, the regional phase of STeP was being carried out, and a certain trend and zones of HC prospectivity have already been identified (**Figure 34**).

STeP is a multi-stage approach that consists of the application of the following methodologies:

- Geodynamic Analysis (GDA);
- Morphometric Analysis (MMA);
- Paleo-reconstruction (PRA);
- Structuremetric Analysis (SMA);
- Spectrometric Analysis (PSP-RSS);
- Conventional Remote sensing;
- Integration of all methods with traditional datasets;
- Other mathematical and geological methods such as artificial neural networks.

A full STeP description is available to better understand the methods carried out as a part of this play-based approach. The brief description is as follows:

- GDA is based on divisibility of the lithosphere, where most mineragenic systems are confined to specific locations that are calculable and inherited. Thus, GDA uses these principles to located zones of prospectivity;
- MMA is based on the principle of erosion basis being connected with tectonics, and it quantifies the erosion network in order to located vertical movements or uplifts irrespective of their lithology;
- PRA represents the interior using the model of flows, which examines the Earth from the perspective of dynamics, or movements within the geomedium, and, among other things, locates depocenters, deltaic features, zones of accumulation that are most favorable for accumulation of HCs, as well as interprets such flow patterns in connection with directions of HC migration;
- SMA uses stress patterns in order to identify paleo-stress and zones of unique paleo-stress that are acoustically different in terms of being HC-saturated;
- PSP-RSS uses spectral manifestations of presence of HCs in the subsurface;
- Other methods are conventional and well-understood;
- Integration of STeP results with conventional datasets, including magnetic, gravity and seismic is a part of the STeP analysis.

STeP is carried out in two major phases: Phase 1 as a regional survey with exploration leads defined based on the scale ranging from 1:300,000 to 1:100,000, and Phase 2 as a local survey with exploration leads defined based on the scale ranging from 1:50,000 to 1:10,000.
The activities/services and deliverables of the survey are defined as follows:

1. During Phase 1, which shall last for 8 calendar month from the date of execution of this contract, of STeP analysis, Contractor shall perform the following Services:
   1.1. Collect from Client and via other available public domain means and sources and analyze the geological, geophysical, geochemical, remote sensing, natural resources exploration records, and such other relevant data in connection with the SERVICE AREA;
   1.2. Conduct assessment of the geological situation of the SERVICE AREA based on the collected data;

1.3. Acquire and select general and specific, digital satellite data/images, and then prepare and process these satellite data/images;
1.4. Conduct Geodynamic analysis at the scales ranging between 1:2,500,000 and 1:300,000, as applicable;
1.5. Conduct Morphometric analysis at the scales ranging between 1:300,000 and 1:100,000, as applicable;
1.6. Conduct Paleo-reconstruction at scales ranging between 1:2,500,000 and 1:100,000, as applicable;
1.7. Conduct Proprietary Spectrometric analysis at the scales ranging between 1:300,000 and 1:100,000, as applicable;
1.8. Conduct Structuremetric analysis at the scale 1:100,000, as applicable;
1.9. Conduct Photogeological studies; the scale and size of features and tectonic movements described in the study will correspond to their surface expression;
1.10. Conduct traditional remote sensing studies onshore, such as thermal, lineament density, and spectral indexes mapping (and/or similar); the selection of such methods and their working scale are subject to the location and geology of the SERVICE AREA;
1.11. Integrate all of the datasets collected via the activities described in items “1.1” through “1.10”, assess HC- prospectivity of the SERVICE AREA, and delineate exploration targets/structures, as applicable;
1.12. Produce a report;
1.13. Produce all cartographic materials.
2.1. Acquire and select additional digital satellite data/images, as needed, prepare and process these satellite data/images;
2.2. Conduct Morphometric analysis at the scales ranging between 1:100,000 and 1:50,000, as applicable;
2.3. Conduct Paleo-reconstruction at the scales ranging between 1:100,000 and 1:50,000, as applicable;
2.4. Conduct Proprietary Spectrometric analysis at the scales ranging between 1:50,000 and 1:10,000, as applicable;
2.5. Conduct Structuremetric analysis at the scale 1:10,000 or better, as applicable;
2.6. Integrate all of the datasets collected via the activities described in items “3.1” through “3.5”, assess HC- prospectivity of the SERVICE AREA, delineate structures contours and determine potential drilling locations within each structure;
2.7. Produce a report;
2.8. Produce all cartographic materials.

3.1. Map(s) showing results of Geodynamic analysis at scale from 1:2,500,000 to 1:300,000, as applicable (from continental/regional scale to local); the results typically consist of a report and maps depicting various geodynamic elements, their analysis, and areas/contours of hydrocarbon prospectivity;

3.2. Map(s) showing results of morphometric analysis at the scale ranging between 1:300,000 and 1:100,000, as applicable; the results typically consist of an analytical report and maps containing varying morphometric constructs, base levels, areas of subsurface uplifts, anticlines, and/or closures;

3.3. Map(s) depicting results of paleo-reconstruction analysis at the scale ranging between 1:2,500,000 and 1:100,000, as applicable (from continental/regional scale to local); the results typically consist of an analytical report and maps containing paleo-reconstructions of the surface at different scales as well as of the base levels that are relevant to the investigations; paleo-reconstructive features and criteria are superimposed to produce a map of prospectivity for different scales and/or paleo-geographic levels;

3.4. Map(s) depicting results of Proprietary Spectrometric analysis at the scales ranging between 1:300,000 and 1:100,000, as applicable; the results typically consist of a short analytical report and map(s) containing spectral anomalies that are indicative of the presence of hydrocarbons;

3.5. Map(s) depicting results of Structuremetric analysis at the scale of 1:100,000 (also other map(s) may be provided at regional scales, as applicable); the results typically consist of an analytical report and maps containing stress fields and contours of targets, but may also include reconstructions of the phases of development of the sedimentary environment and other relevant information and maps as determined applicable in the course of the Services;

3.6. Map(s) depicting results of a traditional remote sensing nature, such as thermal maps, lineament density, spectral indexes, and/or similar with scale ranging from approximately 1:300,000 to 1:100,000, as applicable; the results typically consist of appropriate maps such as minerals indexes, thermal gradients, etc.;

3.7. Map(s) depicting the results of photogeological analysis at scale equivalent to the size and scale of relevant surface features being analyzed; the results typically consist of an analytical report and appropriate maps of showing tectonic structures, directions of tectonic movements, natural phenomena at the surface indicative of certain subsurface events, etc.;

3.8. Map(s) showing the process of superposition and integration of all of the datasets and a resulting map of all exploration leads/structures/anomalies, as applicable, at the scales commensurate with the scale of each type of analysis;

3.9. Map(s) of all of the Deliverables described herein in a cartographic format, such as SHP (shape) or MPK, for ease of Client's integration of STeP findings with the Client's internal G&G systems;

3.10. The report will be delivered in soft copy and is anticipated to include, to the extent determined to be relevant, recommendations on the Service Area's prospectivity with written justifications and geological conclusions drawn from the STeP® findings:

3.10.1. General assessment of prospectivity for HCs;

3.10.2. Indication (mapping) of the contours of HCs prospectivity with scale 1:300,000 to 1:100,000, as applicable to the various parts of the analysis;

3.10.3. Selection of areas of prospectivity as leads or prospects in cartographic format and recommendations on their further exploration priority;

3.10.4. Interpretation of the analysis results and correlation with existing well control and other G&G data, if available.

In summary: the report will contain a myriad of maps, models, calculations and their interpretations leading to the conclusions and maps of contours of potential HC deposits within the Service Area. Such contours are considered high value exploration targets for further exploration. These anomalies will be high-graded in relation to their exploration priority.

4.1. Map(s) showing results of morphometric analysis at the scale ranging between 1:100,000 and 1:50,000, as applicable; the results typically consist of a short report and maps containing varying morphometric constructs, base levels, areas of subsurface uplifts, anticlines, and/or closures;

4.2. Map(s) depicting results of paleo-reconstruction analysis at the scale ranging between 1:1,000,000 and 1:50,000, as applicable; the results typically consist of a short report and maps containing paleo-reconstructions that are relevant to the investigation; paleo-reconstructive features and criteria are superimposed to produce a map of prospectivity for different scales and/or paleo-geographic levels;

4.3. Map(s) depicting results of Proprietary Spectrometric analysis at the scales ranging between 1:100,000 and 1:50,000, as applicable; the results typically consist of a short report and map(s) containing spectral anomalies that are indicative of the presence of hydrocarbons;

4.4. Map(s) depicting results of Structuremetric analysis at the scale of 1:10,000 (or better, as applicable); the results typically consist of a short report and maps containing stress fields, structure contours, drilling locations for each analyzed structure, and target depths;

4.5. Map(s) showing the process of superposition and integration of all of the datasets and a resulting map of all exploration leads/structures/anomalies, as applicable, at the scales commensurate with the scale of each type of analysis;

4.6. Map(s) of all of the Deliverables described herein in a cartographic format, such as SHP (shape) or MPK, for ease of Client's integration of STeP findings with the Client's internal G&G systems;

4.7. The report will be delivered in soft copy and is anticipated to include:

4.7.1. Assessment of prospectivity for HCs of the local-scale targets analyzed in Phase 2;

4.7.2. Mapping of structure contours of HCs of the local-scale targets analyzed in Phase 2;

4.7.3. Table listing coordinates of proposed drilling locations and approximate target depths of potential reservoirs.

In summary: the report will contain a myriad of maps, models, calculations and their interpretations leading to the conclusions and maps of contours of potential HC structures at a local scale. Such contours are considered high value exploration targets for further exploration. These structures will be high-graded in relation to their exploration priority. Recommendations of the next steps are expected to be: limited 3D seismic surveys, geochemical surveys, STeP survey at a more detailed scale such as 1:10,000 or better. If 2D or 3D seismic is recommended, such seismic datasets are expected to validate the STeP structures and help solidify the drilling locations.

Each type of the analysis listed above is being carried out independently and in parallel with its other counterparts. Most of the analysis described herein are typically carried out based on several scales – from regional or even continental to local scales. Upon completion of all the separate types of processing listed above, they are all integrated in GIS and interpreted in connection with the local geology and geophysical information.

The following methodologies have been carried out on regional scale:

Most of the work has been carried out on the regional scale. While some of the work is still digital and can only be ready for showing after the local scale data are processed, below are the examples and evidence of regional analysis completed on behalf of Geodynamic Analysis, Paleo-reconstruction, and Structuremetric Analysis, as well as some maps showing interim results (work in progress) and the integration of these datasets. The regional work shown below is analogous to the play-based geological approach, where all of the available geological and geophysical data are studied to high-grade the Tenement, outline the areas of interest, and generate “plays”. TTR is currently at the stage close to completion of such analysis and is planning to “zoom into” the fairways, trends, and plays for the purpose of outlining local-scale prospects.

2. STEP ANALYSIS PROGRESS REPORT

2.1 GEODYNAMIC ANALYSIS (GDA)

2.1.1 INTRODUCTION – METHOD OF GDA ASSESSMENT OF SUBSURFACE OIL AND GAS PROSPECTIVITY

The main task of this phase of GDA is allocation of a network of geodynamic fluid-discharging nodes in the Earth's crust, as one of the criteria and indicators for HC prospectivity.

The analysis of the target area was carried out using DEM and satellite images at the scales of 1:10,000,000, 1:2,000,000, and 1:500,000. Accordingly, the interpretation entailed three stages of work to accommodate for the three scales.

In general, lineaments and zones of arc morphology delineated by GDA are fragments of concentric structures that make up the transregional structural grid/framework of the geomedium's fault system. Such structures indicate that there exist "transport channels" carrying reduced fluids to the upper horizons of the Earth's crust. These channels are "guarantors" of HC-generative processes, if other favorable structure-geodynamic conditions are met. Such conditions are:

- Optimal degree of faulting/displacement for HC's migration and accumulation;
- Intersections of tectonogens of different ranks, their zones of dynamic influence, and concentric structures;
- Existence of HC collectors, seals, and traps.

Intersections of such major structures always cause groups of concentric displacement of varying power and diameter.

The phenomenon of deep degassing of the Earth's entrails is known. Its major components are H2, He, CO, CO2, CH4, N, F, S, and others. Gases, including hydrocarbons, are carried into the crust from the mantle by flows of "reduced fluids". Their focused introduction into the lithosphere mainly occurs via injection mechanisms similar to plumes. The consequences of such a process are active seismogenesis, intense morphological and lithodynamic movements of the crust, systemic structural organization of the geomedium, as well as an intense and varying mineralization that accompanies these processes.

The products of degassing are directed (along with a variety of commercially valid components) via faults/permeable zones that are called "tectonogens". Their locations correspond to strict systems of locations on the surface that make up the Earth's framework. Such a skeleton of tectonogens can be traced on the entire surface of the globe.

The organization of the carcass of tectonogens (i.e. their mapped locations on the Earth's surface) follows the symmetry system of regular polyhedrons. Two systems of organization of the geomedium correspond to the history of Earth's development:

1. Cube-octahedral system (**Figure 1**) formed and influenced the geosphere mostly in the Early Precambrian. The regular polyhedrons are cube and an octahedron as illustrated are both inscribed in the sphere, which is the Earth's geoid in this case.

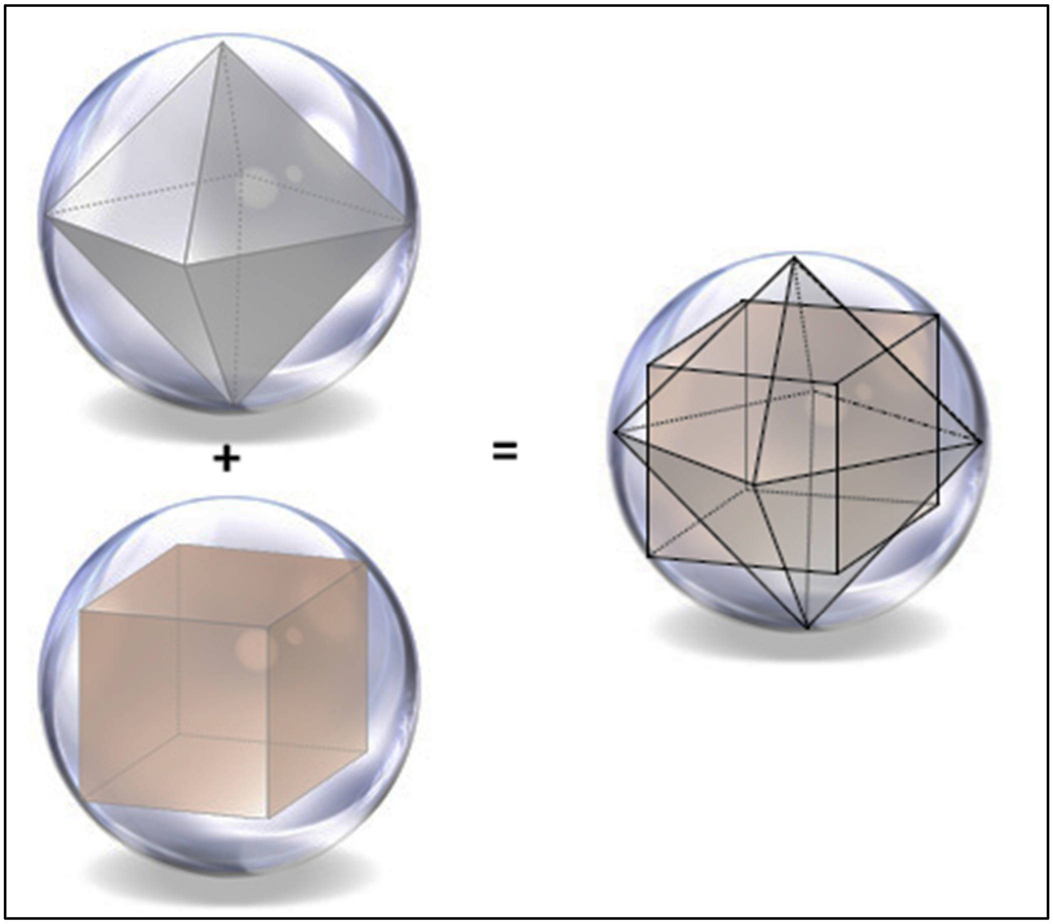


Figure 1: General model of Cube-octahedral symmetry system of Earth organization.

All the edges of these two polyhedrons "project" onto the surface, and their detection is fundamental for the study and analysis of a territory using GDA.

GDA postulates that the cube-octahedral system ended its development in early Proterozoic (about 2.5 billion years ago) in the beginning of a strong tectonic-magmatic activation (TMA[1]), which influenced the second system of organization of the geospace.

[1] ***Tectonic-magmatic activation (TMA)*** *- the process of increased intensity of tectonic movements and magmatism that usually manifested after the period of relative tectonic quiescence. It is characterized by varying tectonic deformations and rifting and is associated with either assent of heated lightweight fluids from the mantle to the base of the crust or collision of continental lithospheric plates and heating of their lower parts. TMA lasted over a considerable period of the Earth's history, at least since the beginning of Proterozoic (2.5 billion years ago) and more clearly and fully in Mesozoic. TMA is associated with the formation of numerous deposits of metal ores, rare elements, precious stones, and other natural resources.*

2. The icosahedron-dodecahedral system (**Figure 2**) began its development with the onset of TMA in the early Proterozoic. The role of regular polyhedrons is played by icosahedron and dodecahedron. Like cube and an octahedron described above they are both inscribed in the sphere of the Earth's geoid as illustrated in **Figure 2**, they provide a different tectonogen framework as compared with the cube-octahedral system.

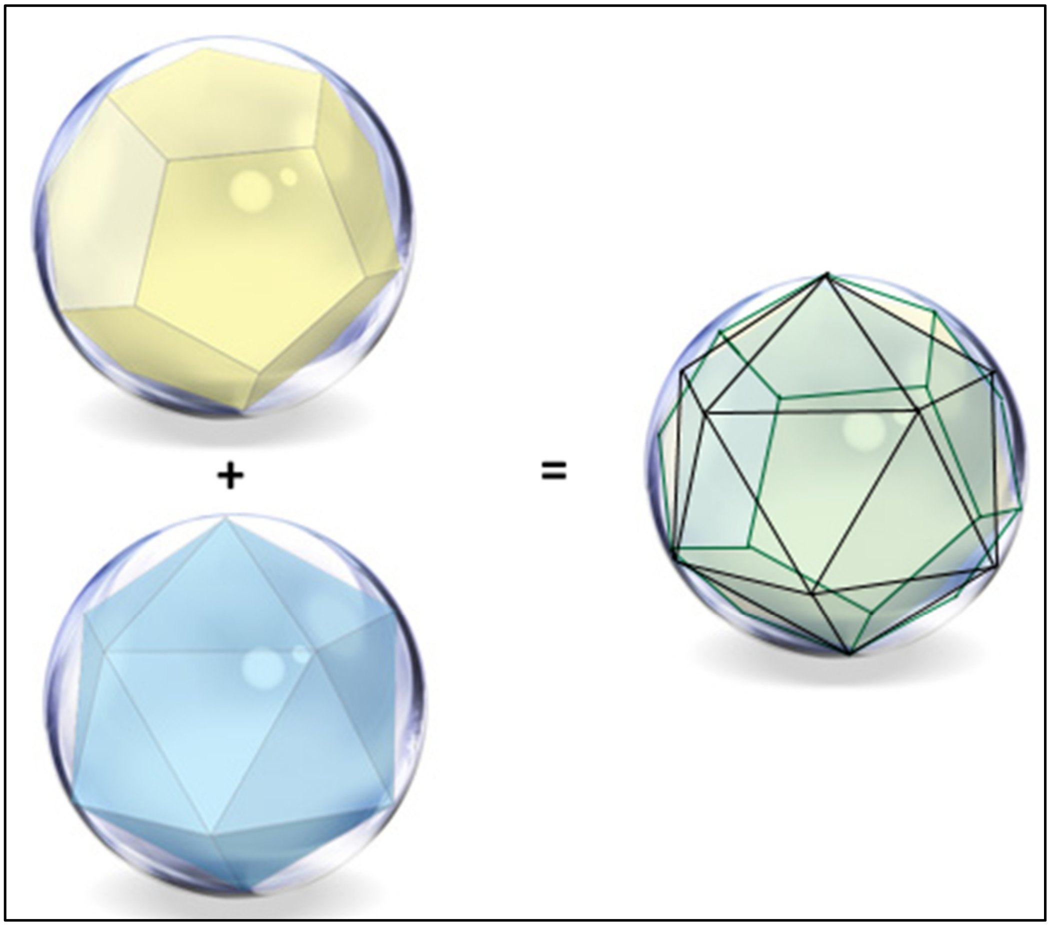


Figure 2: General model of icosahedral-dodecahedral symmetry system of Earth organization.

Tectonogen is a linear structure that can manifest at the surface of the Earth, and its orientation/direction coincides with the orientation/direction of the edge of a regular polyhedron of any of the symmetry systems.

Tectonogen is the line of intersection of an imaginary plane drawn through any two edges of a regular polyhedron with the surface of the Earth. The example in **Figure 3** shows four edges (two green and two burgundy ones numbered 1 through 1a) of the facet F1. Tectonogen T1 can be delineated by extending the plane of facet F1 to the surface of the sphere of the Earth (red ellipse). The edge of this facet 1 is involved in the formation of other tectonogens T2 and T3, which demonstrates that this the facets of both polyhedrons manifest at the surface as multiple tectonogens.

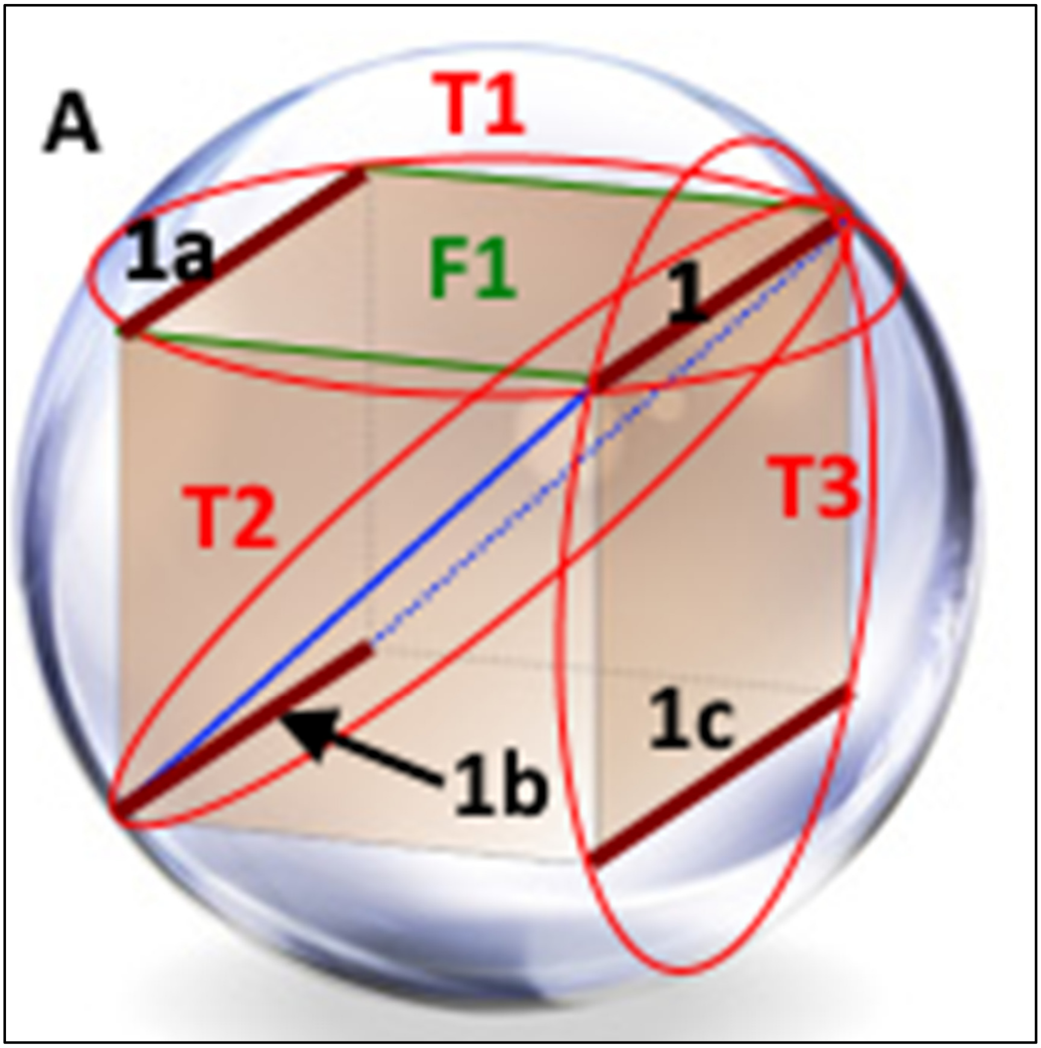


Figure 3: Principle of formation of tectonogens.

Because the Earth's interior is heterogeneous, the surface would not reflect a clear and well defined expression of a tectonogen. The geological life of the planet can change the position of a tectonogen or even fully erase its morphological manifestation. Nevertheless, indirect signatures of such tectonogens can be traced using, for instance, secondary tectonogens that extend parallel to the place of the main one. The width of an area where secondary tectonogens can be traced on either side of the main one is the zone of its dynamic effects or the Zone Dynamic Influence, abbreviated as ZDI (**Figure 4**).

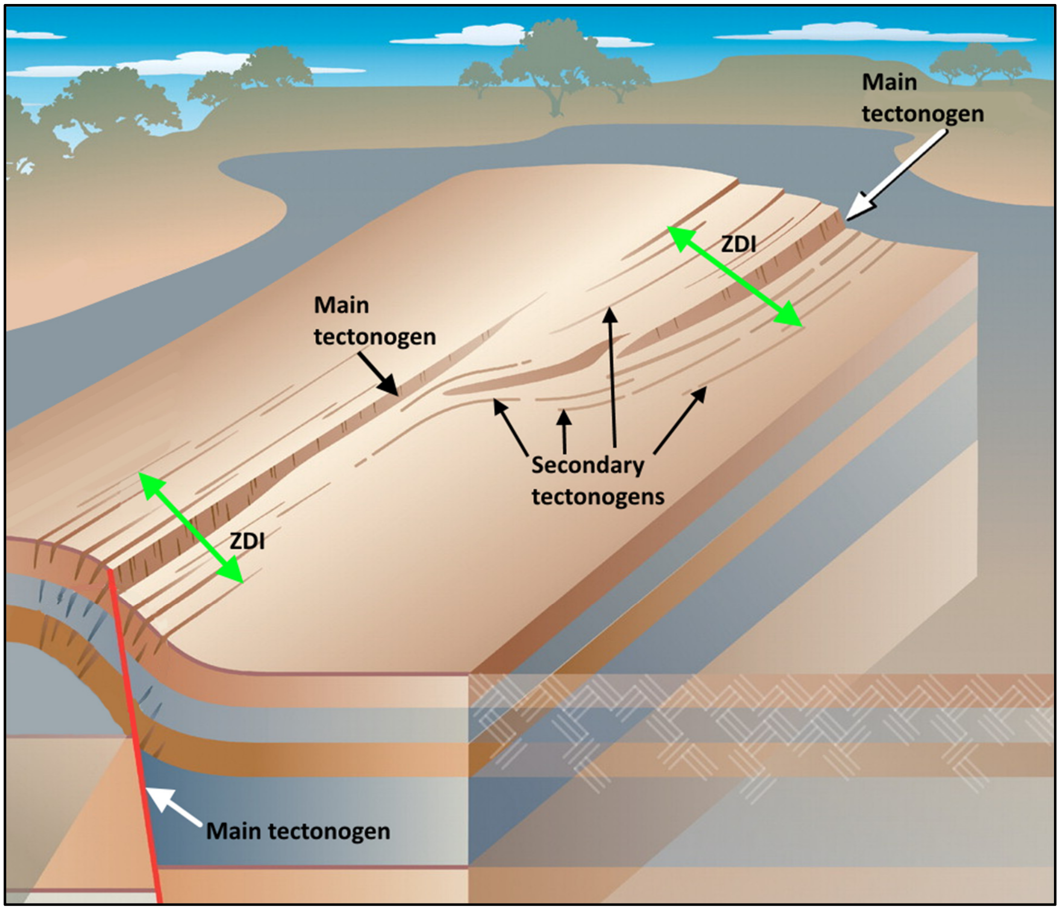


Figure 4: Schematic image of tectonogen relations.

Intersecting tectonogens form nodes that are essential elements of GDA. If tectonogens are fractured and permeable zones connecting the interior of the Earth to its surface, an intersection of two or more of tectonogens makes up a stem channel of an enhanced deep fluid discharge. Accordingly, the near-surface region above such a node is the area of high-energy charge of the geomedium, its tectonic stress, and active disintegration of near-surface sediments and rocks. The surface morphology of such areas is often represented by diverse depressions and arched, circular structures. **Figure 5** illustrates a schematic example of such a structure, where three tectonogens (T1, T2, and T3) intersect and form a node that serves as an epicenter of multi-ring systems of concentric structures (MSCS), which are marked green in **Figure 5**. The outer contour is a circular depression (downfold).

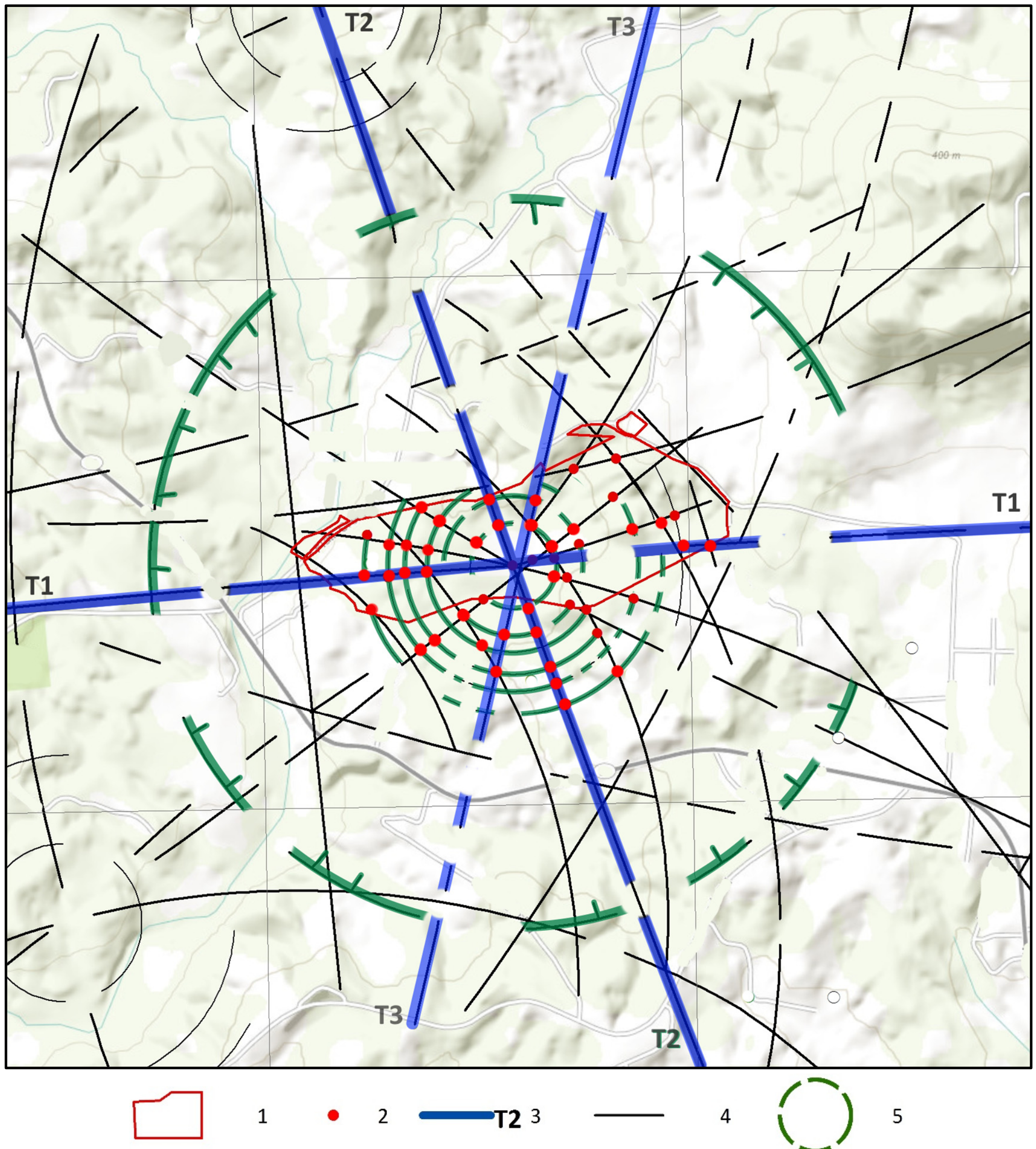


Figure 5: Example of a typical MSCS.

1 – Third-party area of interest; 2 – Fluid-dynamic nodes; 3 – Tectonogens; 4 – MSCS concenters and minor tectonogens; 5 – Depression concenters

The GDA methodology includes the following:

1. Deciphering of tectonogens, lineaments, and concentric structures using varying cartographic, satellite, elevation and other materials (geological, geophysical, and tectonic).

2. Location of nodes of intersections of tectonic-dynamic zones that serve as fluid discharge zones.

3. Delineation of zones of active fluid discharge as contours of zones with high density of said nodes. Such territories are primary objects of prospecting for hydrocarbons.

2.1.2 GENERAL DEPENDENCIES OF THE STRUCTURE SYSTEM OF THE AUSTRALIAN CONTINENT AND TASMANIA

The first approximation that zooms into the solution of the geodynamic problem for the given AOI considers the global indicators of systemic manifestations of the main framework tectonogens in the geological space and their placement within the continent (**Figure 6** and **Figure 7**).

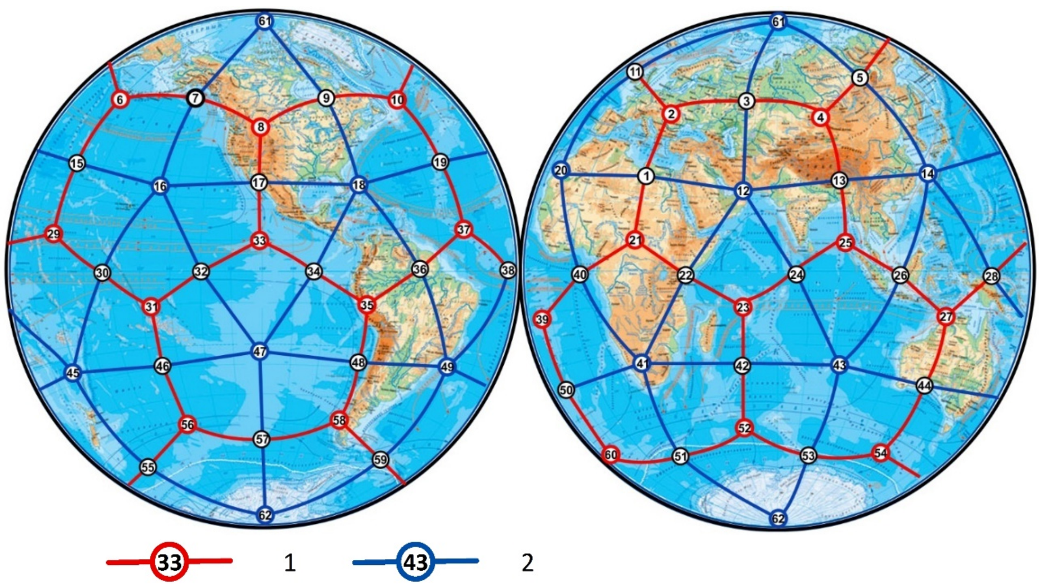


Figure 6: Simplified scheme of tectonogen grid of Icosahedral-dodecahedral symmetry system of Earth's organization.
1 and 2 – Main Earth's tectonogens with nodes

The general directions of geological development within the area of interest are the components of the icosahedron-dodecahedron tectonogen framework of the interior's organization. GDA distinguishes four major nodes of intersection of planetary tectonogens that influence the Australian continent (**Figure 7**) including AOI.

The cube-octahedral system of tectonogens on the continent is weakly developed and can be traced only within its certain local manifestations.

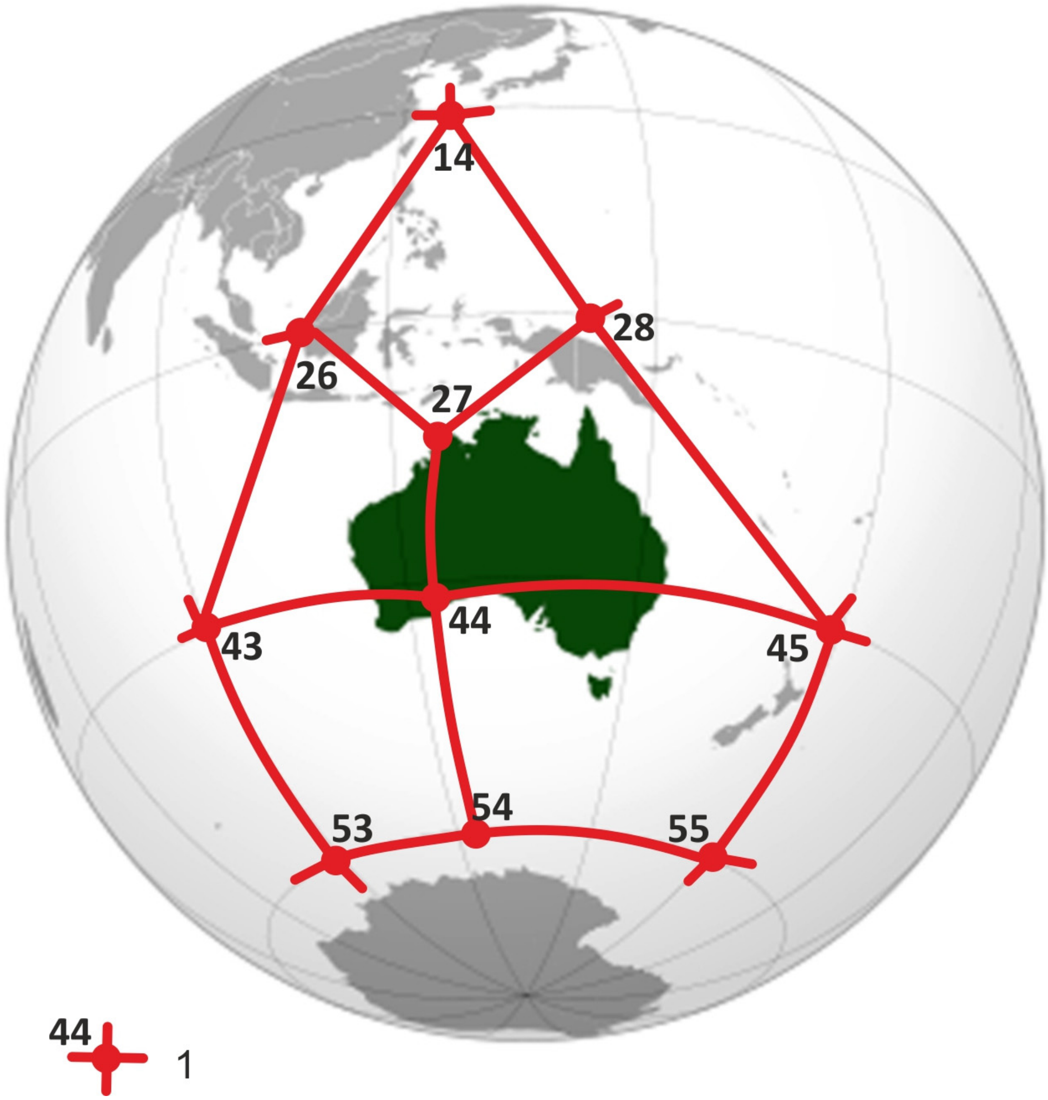


Figure 7: Fragment of the trans-planetary system of geodynamic control with 4 major nodes of Australia.
1 – Main Australian tectonogens with nodes

2.1.2 GEODYNAMIC ANALYSIS AT 1:10,000,000

This phase of GDA is performed at the scale of 1:10,000,000. Satellite, digital elevation, geological and geophysical maps are evaluated to identify the main structural criteria of the systemic organization of Tasmania (**Figure 8**).

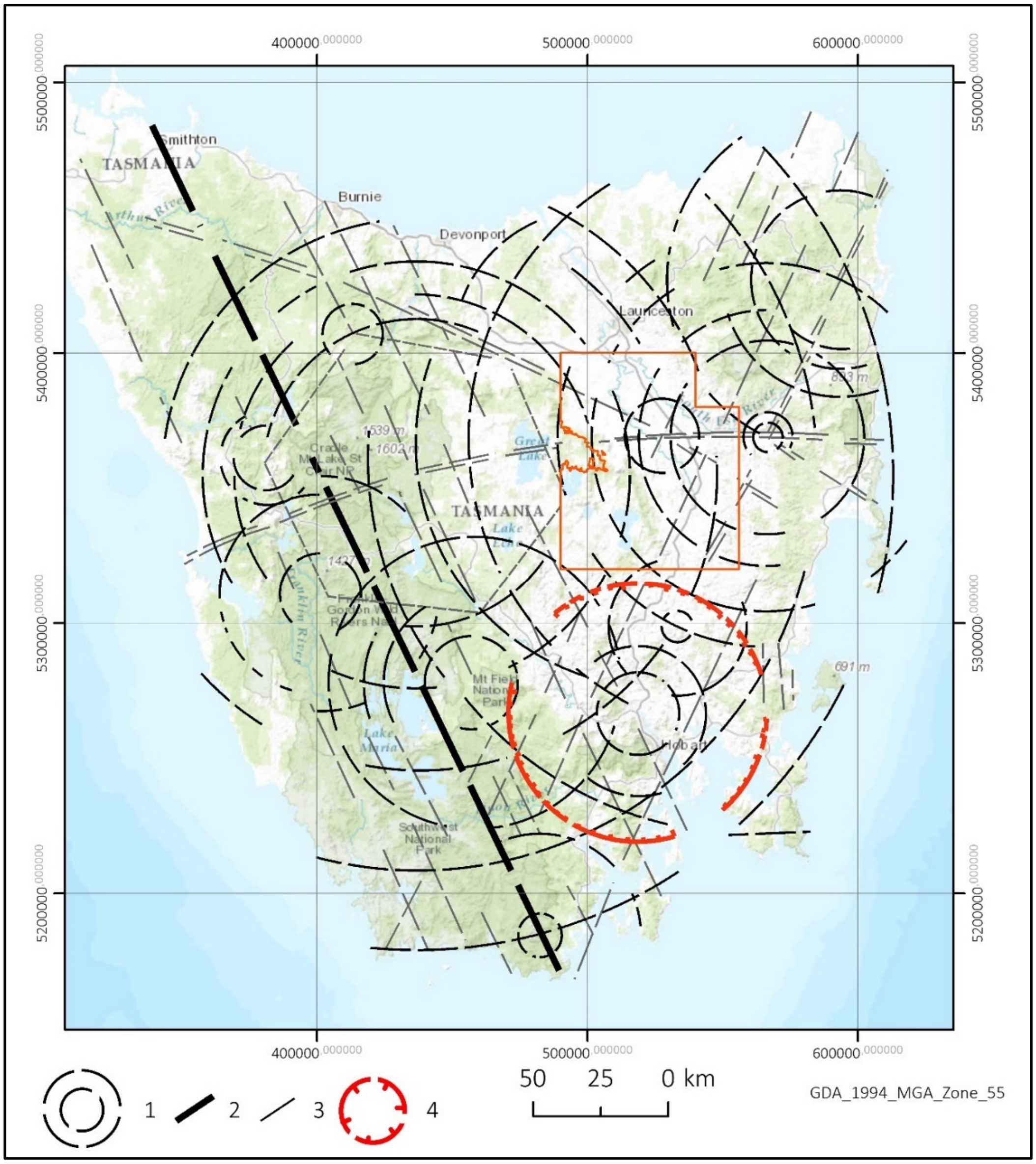
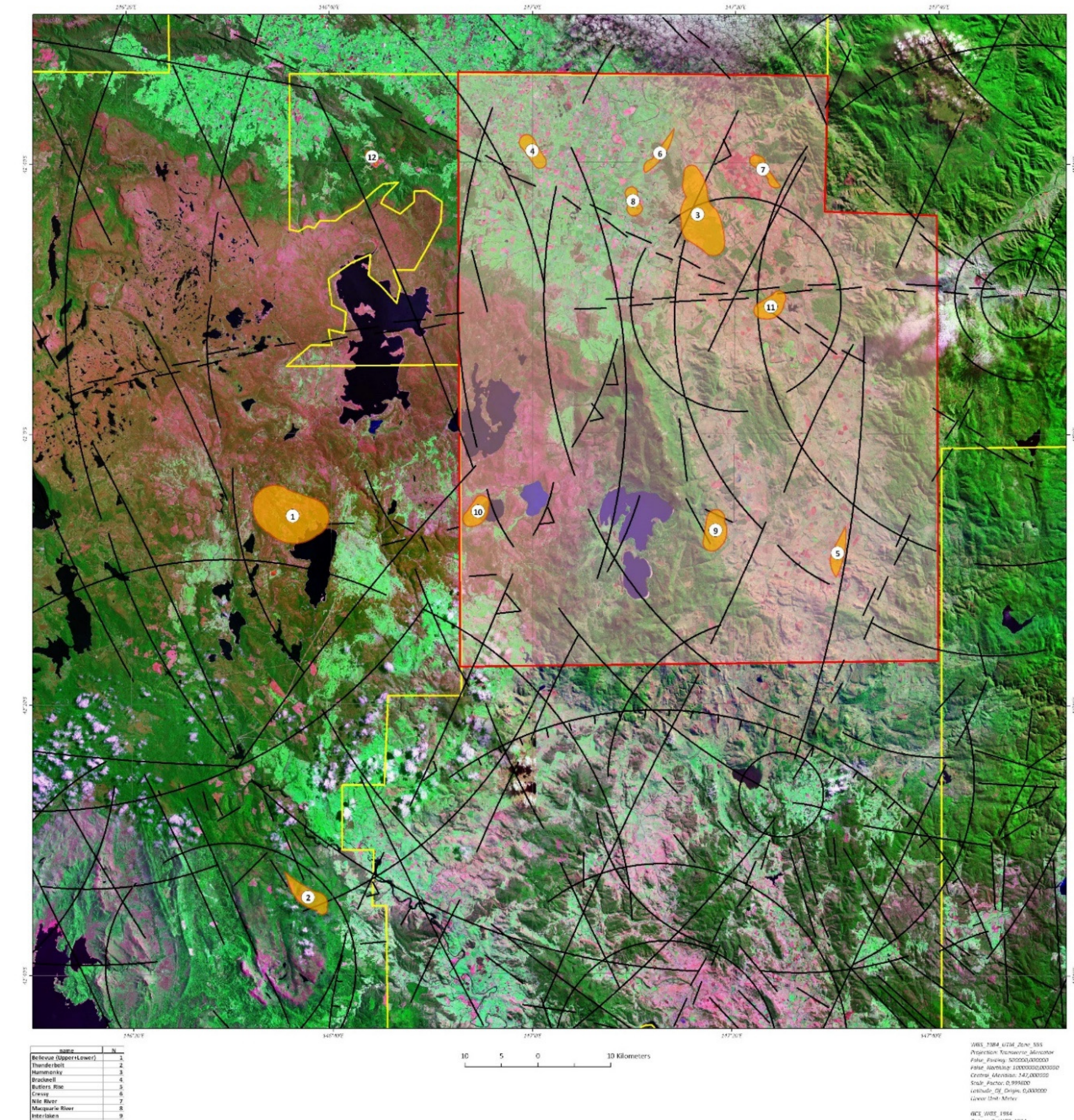


Figure 8: General Geodynamic observation of Tasmania.
1 – MSCS; 2 – major tectonogen; 3 – ZDI of major tectonogen; 4 – major downfold

GDA is currently ongoing with work performed at regional scales. The main regional GDA constructs shown in **Figure 8** reveal several MSCS controlling Tasmania. One of the circular structures within AOI is formed as an intersection of several important geodynamic constructs.

In the next stages of GDA, the results shown in **Figure 8** are to be examined at higher scales and interpreted in connection with HC prospectivity of AOI. **Figure 9** shows the regional geodynamic constructs in relation to the location of seismic targets defined by other geoscientists. Most of these targets, such as numbers 3 and 12, are confined to quantized circular structures of the identified MSCS. In the later stages of geodynamic analysis and other phases of STeP, these matters will be reexamined and integrated with existing geological and geophysical datasets.



name	N
Bellevue (Upper+Lower)	1
Thunderbolt	2
Hammonky	3
Bracknell	4
Butlers Rise	5
Cressy	6
Nile River	7
Macquarie River	8
Interlaken	9
Steppes	10
Stockwell	11
Quamby Fault block	12

Figure 9: Geodynamic constructs – regional analysis (work in progress) and seismic targets.

2.2 MORPHOMETRIC ANALYSIS (MMA)

2.2.1 AREA OF INTEREST (AOI)

AOI is shown in **Figure 10**.

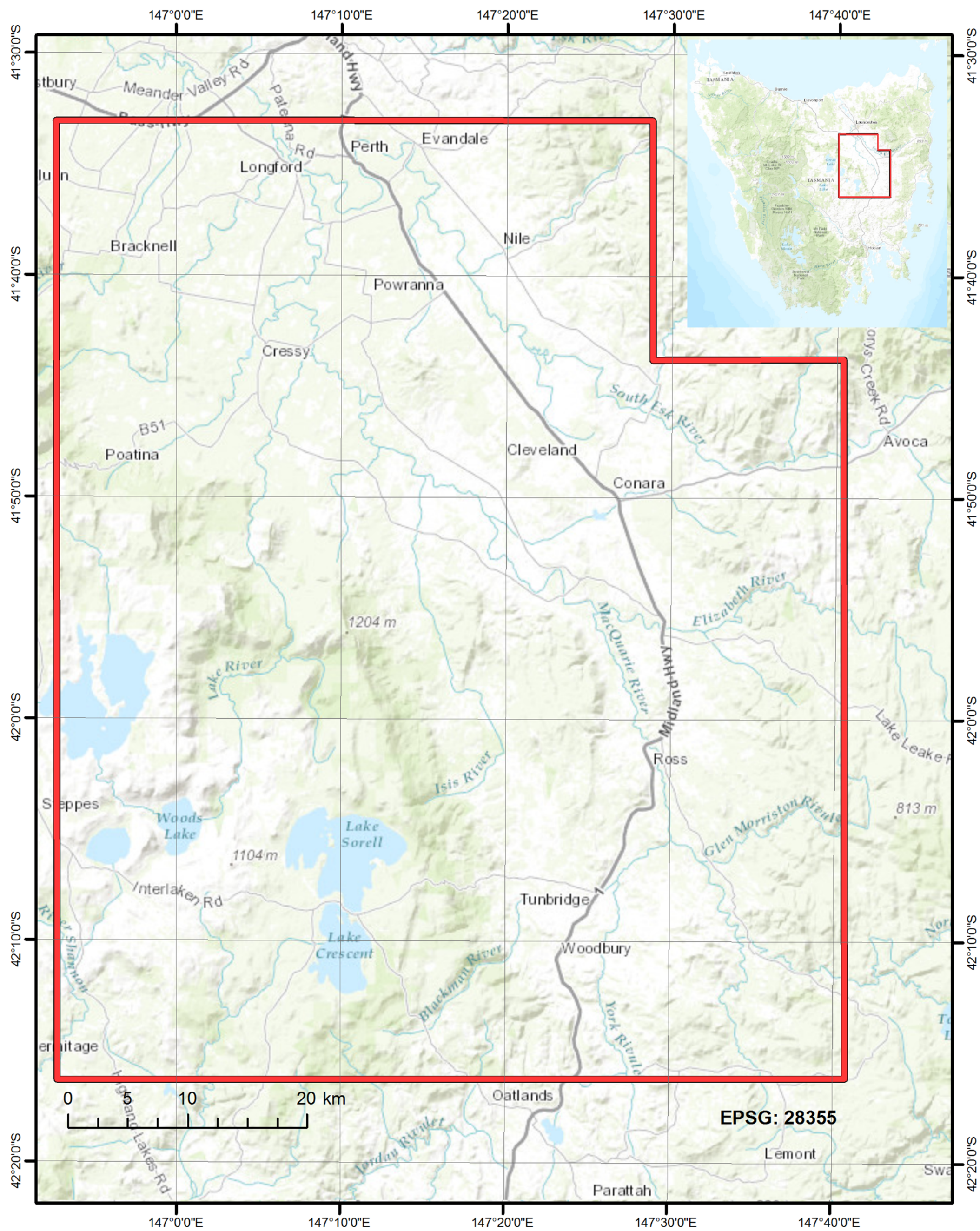


Figure 10: Location of AOI.

In order to apply MMA successfully to the AOI, the areas covering the upper basins of temporary and permanent streams passing through AOI shown in **Figure 11** was processed.

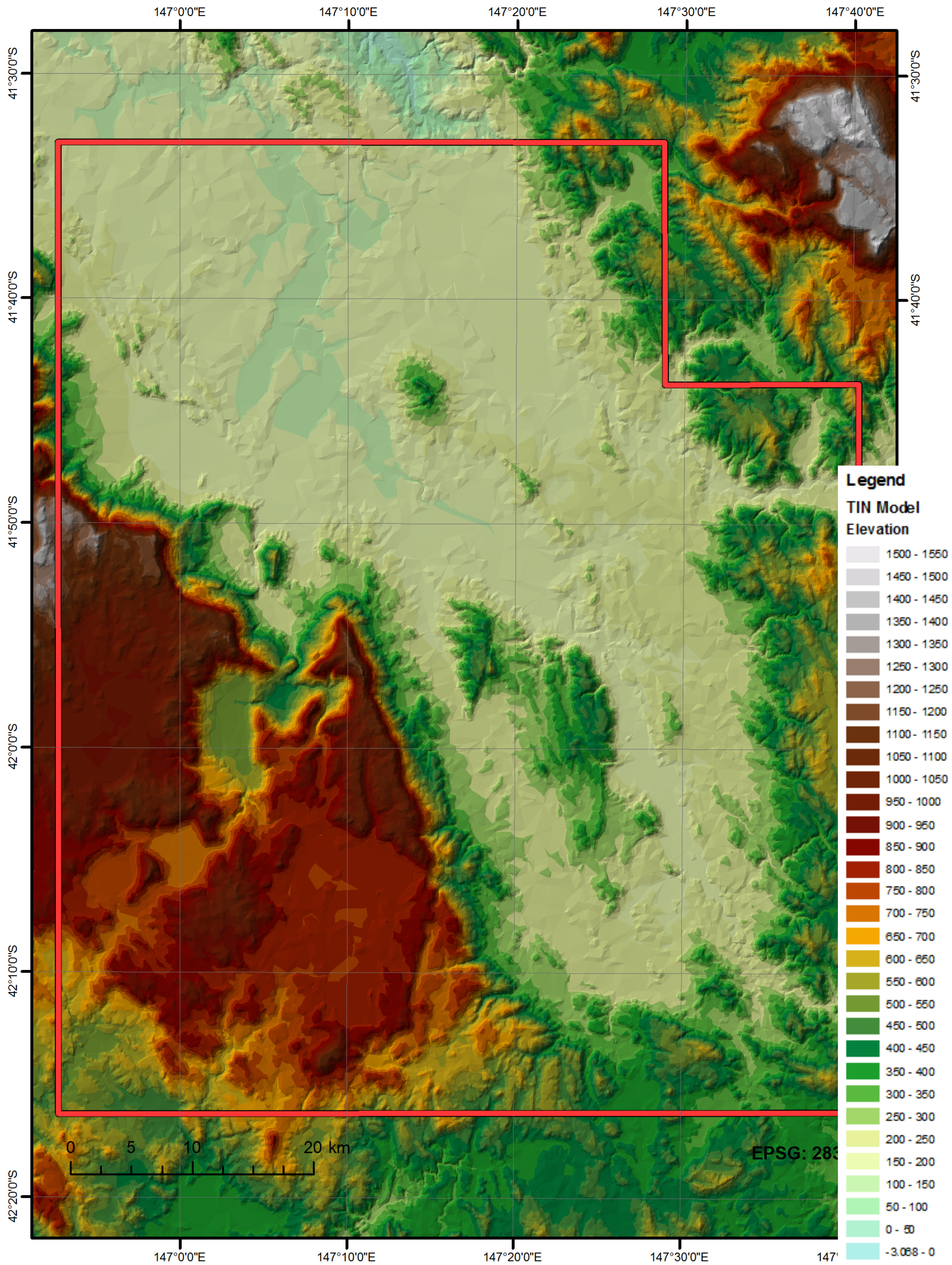


Figure 11: Digital Elevation Model (DEM) of AOI.

2.2.3 MORPHOMETRIC PROCESS

MMA of the surface relief is primarily aimed at locating buried anticlinal uplifts using DEM as the data source. This method is based on a proven genetic relationship between various geomorphological features of the relief/landscape, tectonic processes, and buried geological structural forms that may contain hydrocarbons and be of prospecting interest.

2.2.2 MAPPING OF EROSION NETWORK AND DETERMINATION OF STREAMS ORDERS

A stream order map is the foundation of morphometry used to make all subsequent maps, constructs, and transformations. It is based on the approach described by Strahler (1952). According to the approach of stream order determination, a stream of the first order is defined as the stream that does not receive any inflow streams/tributaries, i.e. unbranched. Streams of the second order are formed by two first order streams. Streams of the third order are created when two second-order streams merge. Higher order streams are defined analogously. First or second order tributaries to a third order stream do not increase its order. Therefore, the stream order gradually increases from upstream to lowlands. The main valley/stream has the highest order, which increases from upstream to lowlands via a merger of streams of the same order.

As shown in **Figure 12**, eight streams (from the 1st to 8th) orders have been determined within AOI.

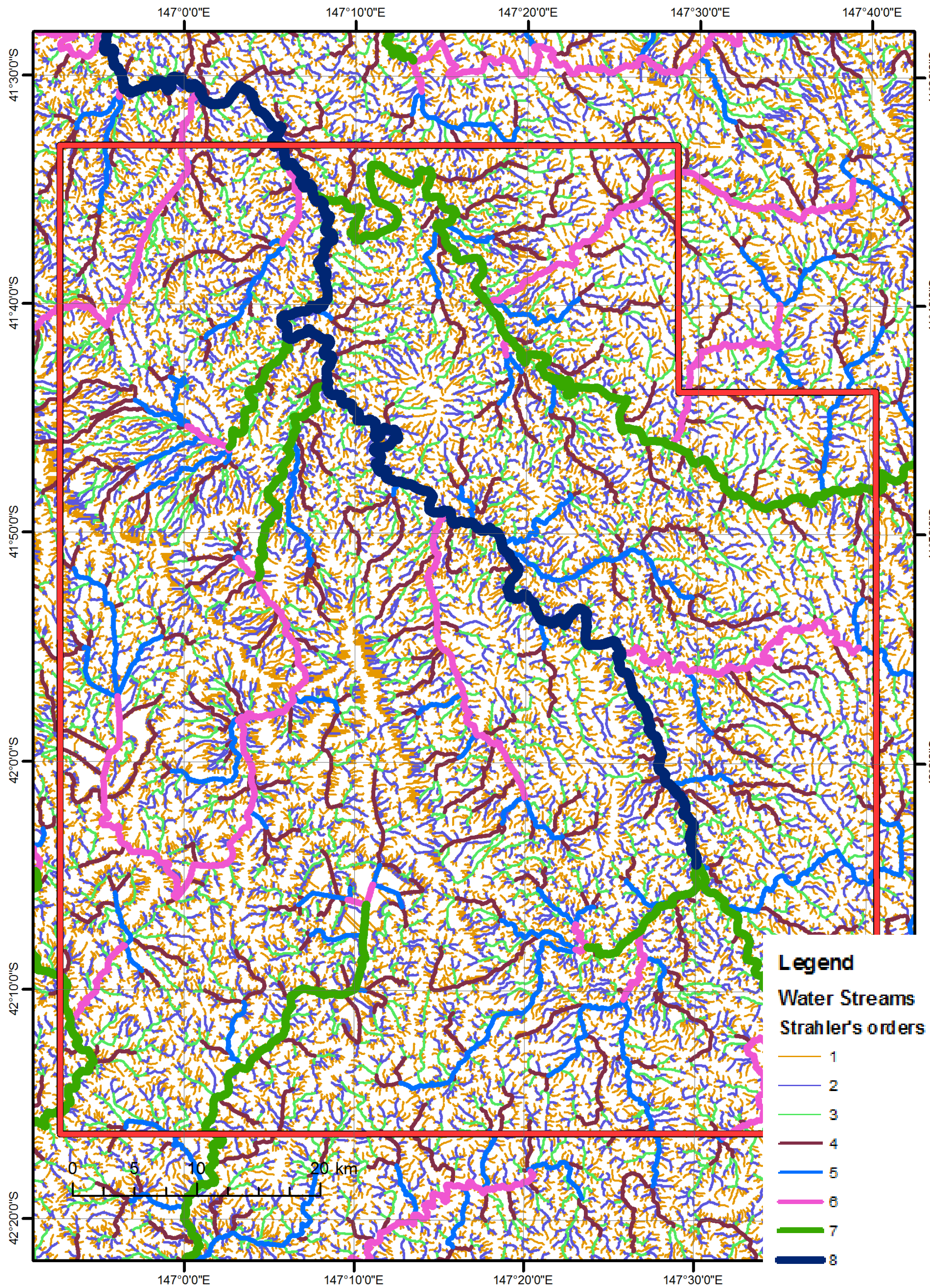


Figure 12: Streams order map and AOI's drainage network.

The first order stream could not be used, because it reflects the youngest processes directly related to the present-day relief. Thus, the 1st order isobase surface (Base Level 1) was virtually identical to the existing landscape and was excluded from the analysis. Streams map of the 8th order was also omitted as not informative.

2.2.4 BASE LEVEL MAPS

The morphometric term of Isobase Surface (or Base Level map) is based on the term of "basis of erosion", which first introduced by Powell[2] in 1873. An Isobase Surface is a complex surface going through valley thalwegs, which make up the framework of such a surface. Therefore, a Base Level is a surface that unifies local bases of erosion.

Data required for creation of Base Level[3] maps has been extracted from the Streams Order maps and DEM. Base Level maps have been produced within the GIS environment via creation of point vector layers combined dimensionally with streams of appropriate orders and having elevation attributes. Isoheight contours of local erosion bases are interpolated lines drawn through the points of equal elevation. These lines are isobases. In accordance with the theoretical postulates of morphometry, isobases cannot be placed lower than isoheights of the present-day surface (represented hypsometrically); they cannot intersect, cannot cross the same watershed twice, and they must cross talwegs of valleys at the right angle. The example of a Base Level map construction is shown in **Figure 13**.

[2] ***http://en.wikipedia.org/wiki/John_Wesley_Powell***

[3] ***http://itc.gsw.edu/faculty/bcarter/physgeol/river/base.htm***

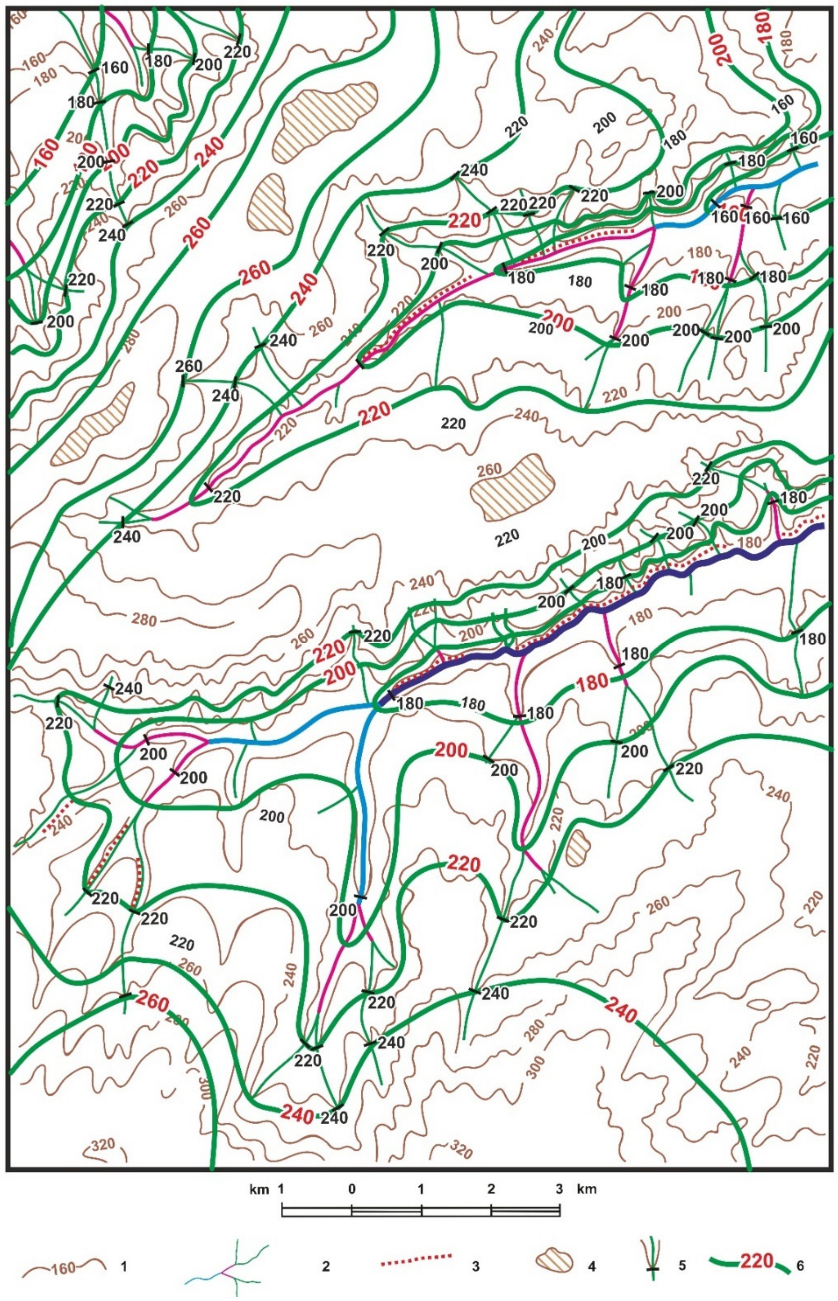


Figure 13: Example of creation of a Base Level map

1 – isoheight lines and their heights;
2 – streams of various orders;
3 – lines of asymmetry of valleys;
4 – hills;
5 – elevation of talwegs of valleys;
6 – isobase lines and their elevations.

The Base Level maps that have been created in accordance with the aforementioned rules reflect the local erosion bases for the area at different geological periods. The initial Stream Order used to create such a map determines the order of a Base Level. A set of separate Base Level maps has been created for AOI. Base Levels of higher orders lie below lower order Base Levels. There is a significant difference in elevations between the Base Level maps and the Hypsometric surface, which difference increases with the order of a Base Level.

Base Level maps, provided via raster images of drainage/erosion bases, have been created and are presented in **Figure 14**, **Figure 15**, **Figure 16**, **Figure 17**, **Figure 18**, and **Figure 19**.

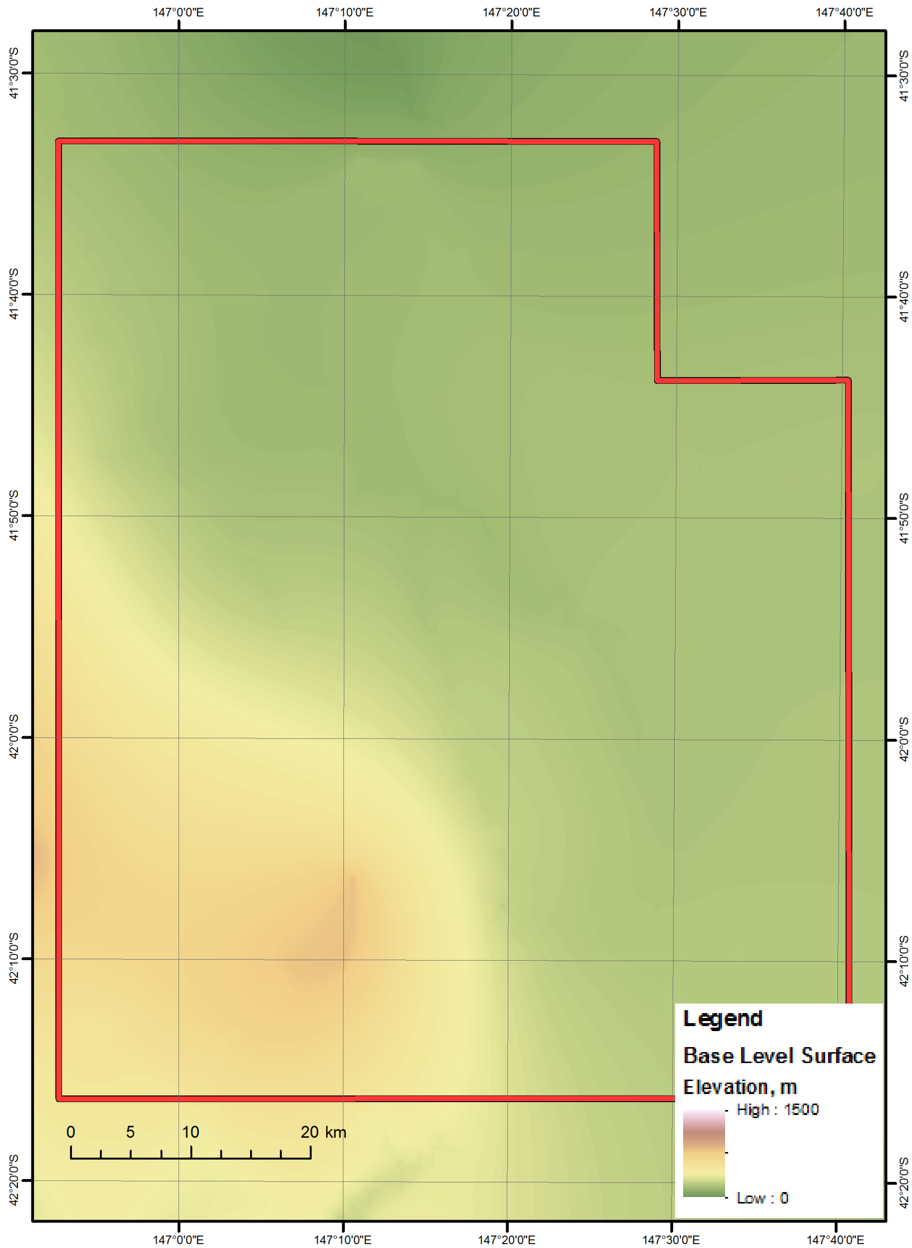


Figure 14: Base Level 7 surface.

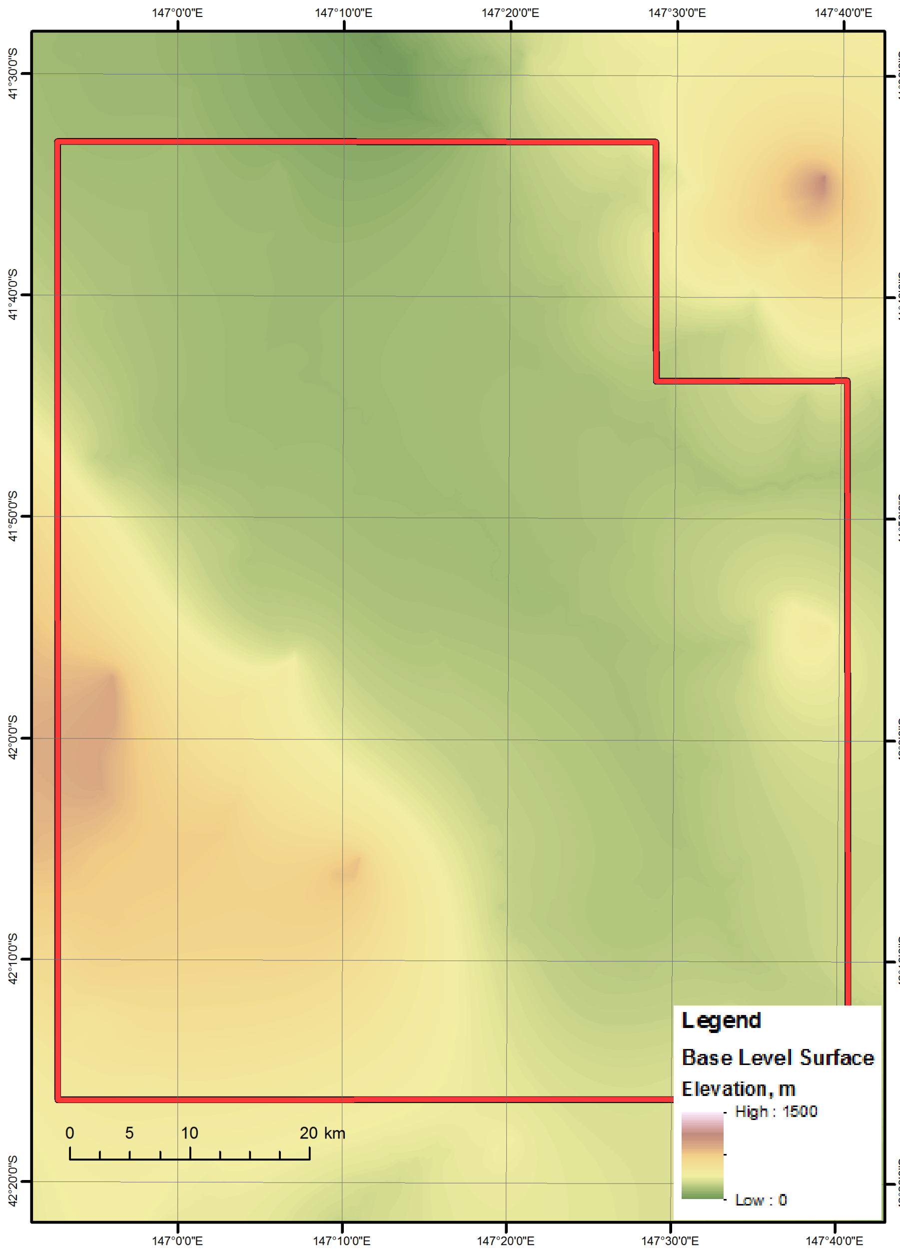


Figure 15: Base Level 6 surface.

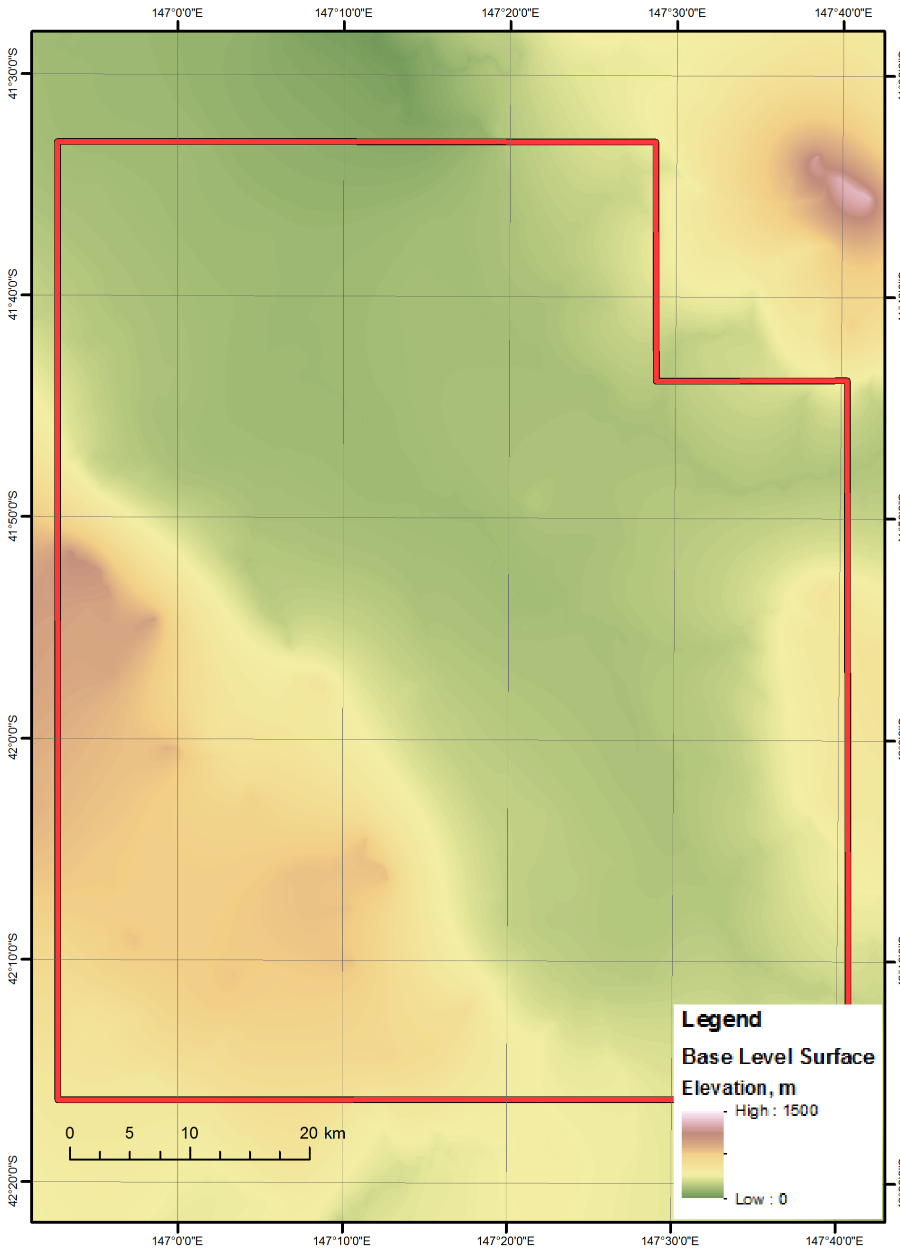


Figure 16: Base Level 5 surface.

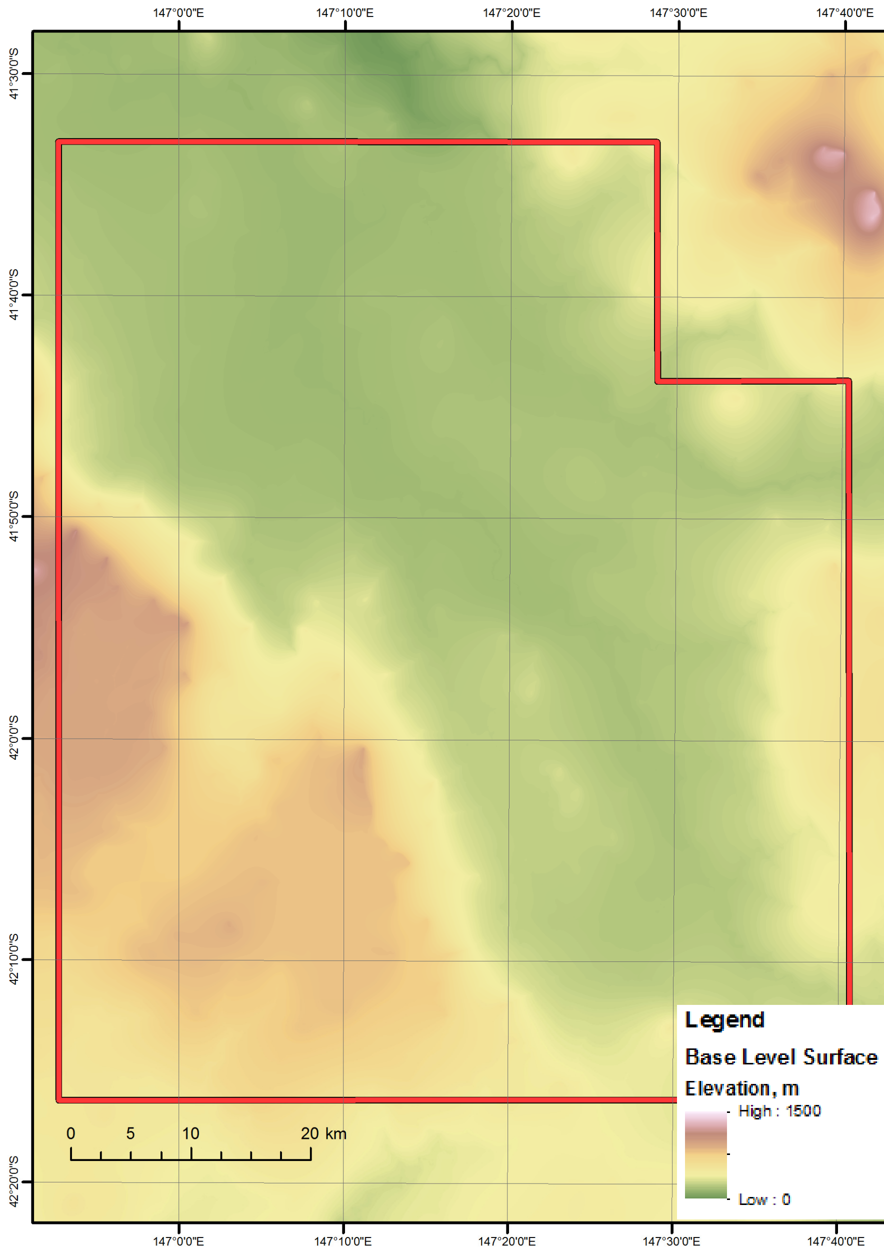


Figure 17: Base Level 4 surface.

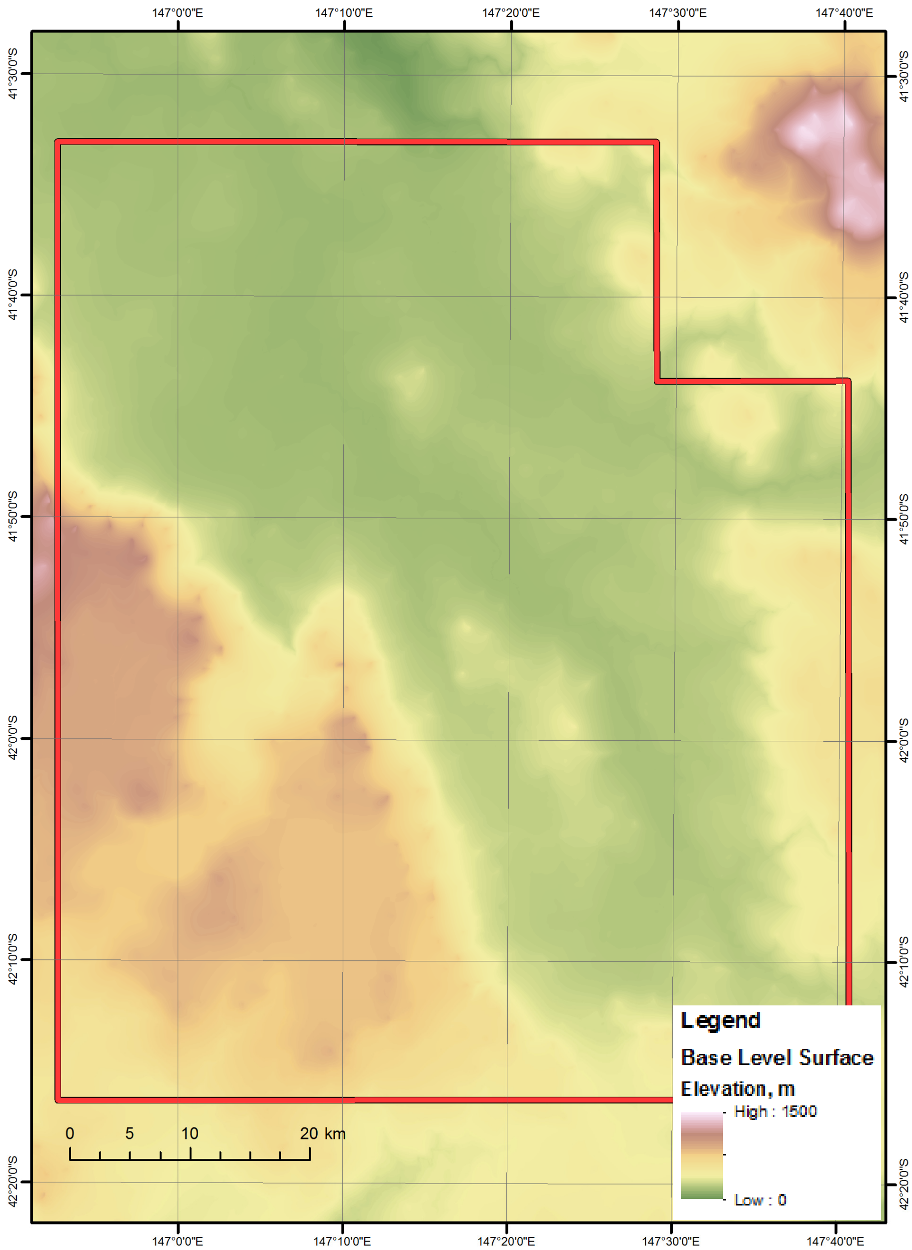


Figure 18: Base Level 3 surface.

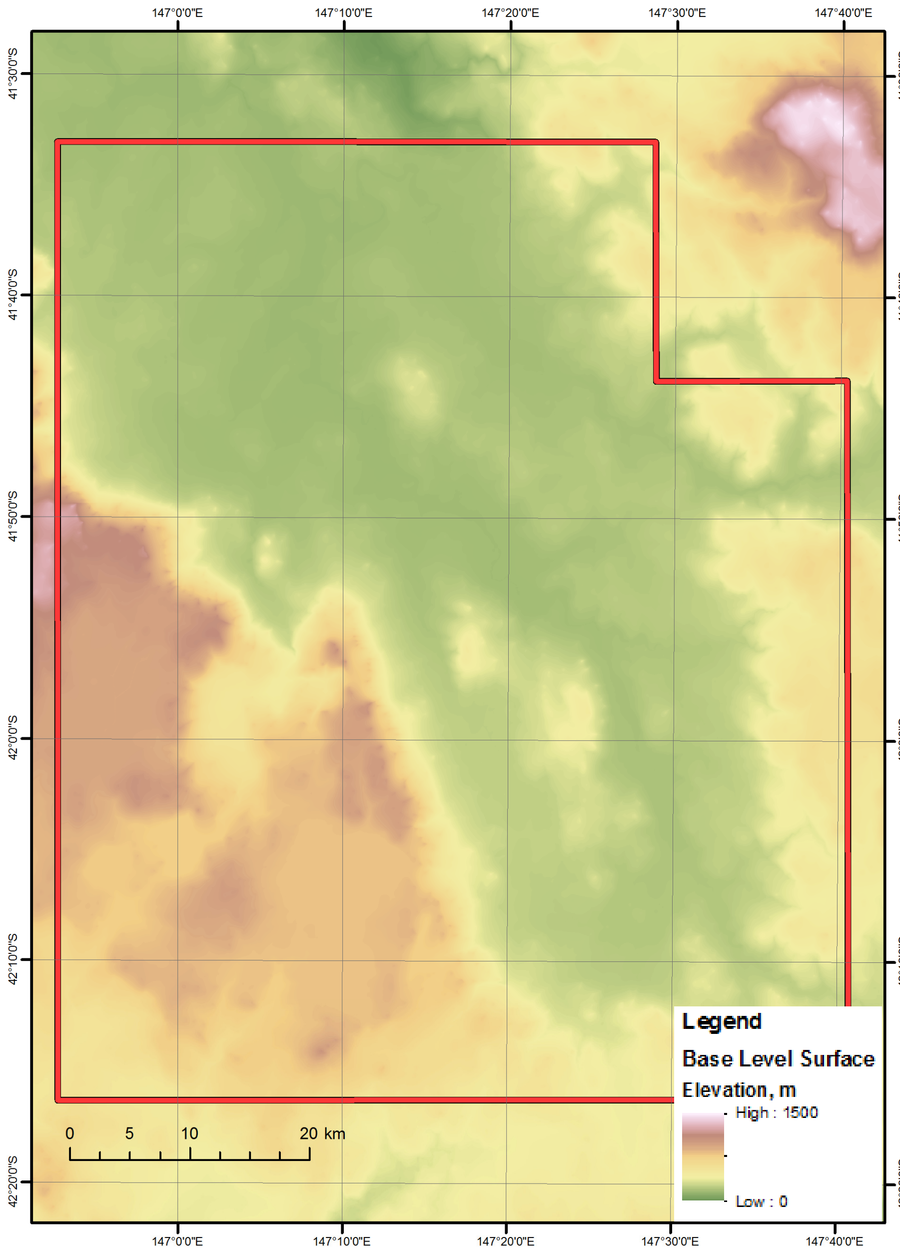


Figure 19: Base Level 2 surface.

2.2.5 RESIDUAL RELIEF MAPS

Residual relief consists of positive relief forms that lie above a given Base Level. Residual Relief maps show the volume of geomedium, which could be removed in the future via erosion and denudation given the analogous geological, physical, and geographic conditions. This volume is calculated as an algebraic difference between the elevation of a hypsometric (current day) relief and the elevation of any Base Level. Hypsometric minus Base Level equals Residual Relief - the volume of geomedium that is deposited above the Base Level. The higher the order of a Base Level, the greater will be the values of the corresponding residual relief.

The quantity of Residual Relief maps is equal to the number of Base Level maps. Every Base Level corresponds to its residual relief. The higher the rank of the Base Level, the larger the mass quantities attributed to residual relief.

There are two types of residual relief - regional and local. Regional residual relief is a background type of relief that reflects the character and direction of the regional dip. Local residual relief reflects local tectonic activity, which can be interpreted to extract geologically meaningful data. Deducting regional residual relief (trend component) from the cumulative residual relief map renders informative Local Residual Relief maps.

The Residual Relief maps corresponding to Level 7 through Level 2 of AOI are provided in **Figure 20**, **Figure 21**, **Figure 22**, **Figure 23**, and **Figure 24**, and **Figure 25**.

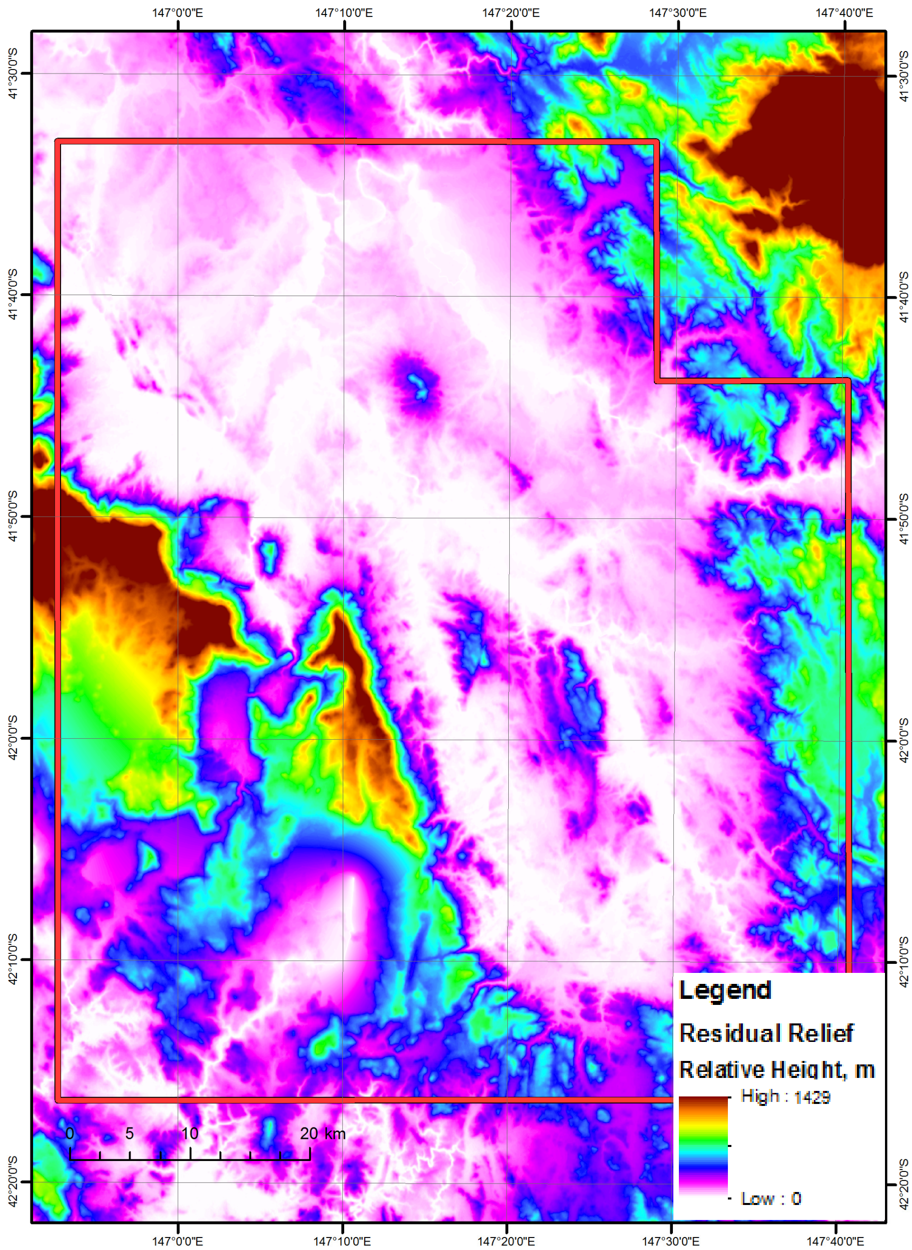


Figure 20: Residual Relief map corresponding to Base Level 7.

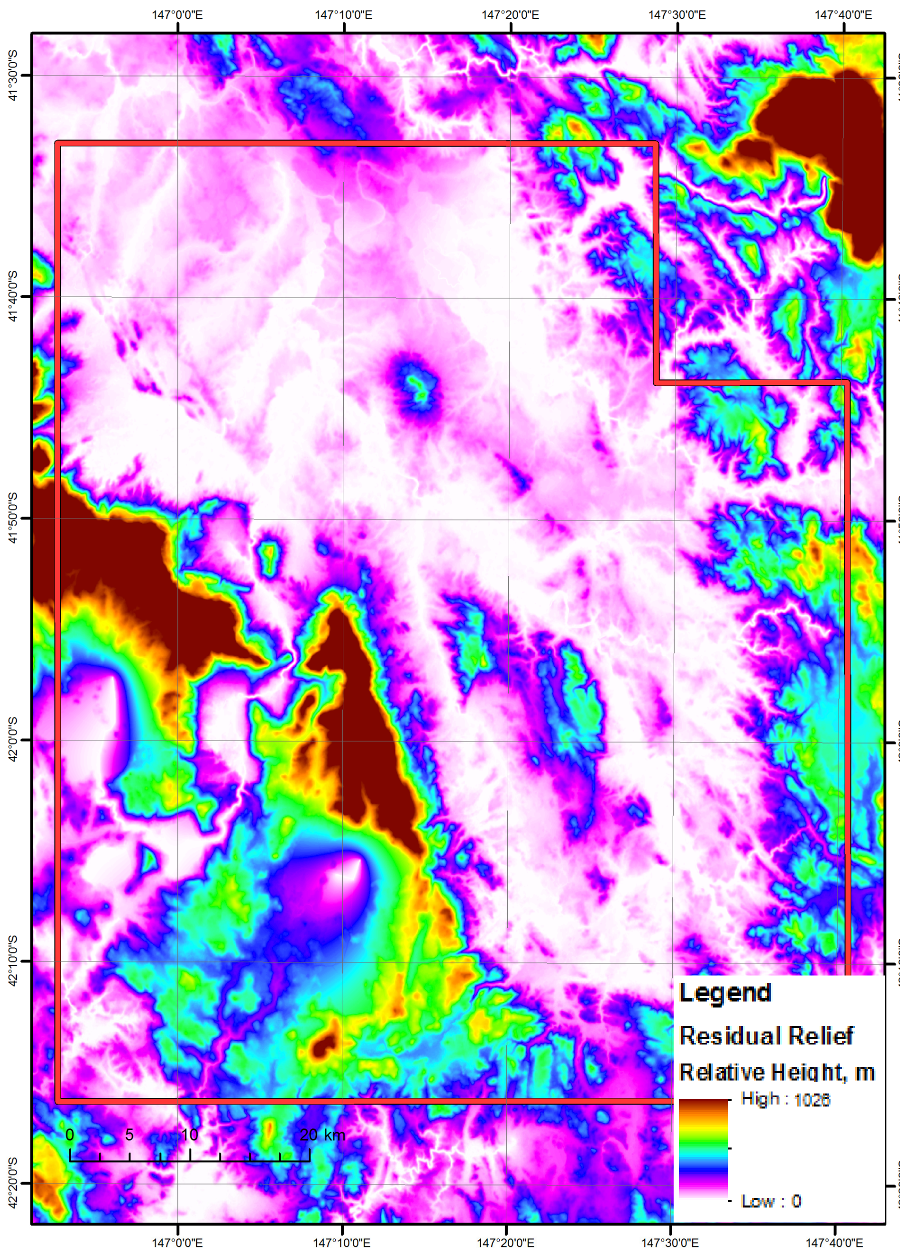


Figure 21: Residual Relief map corresponding to Base Level 6.

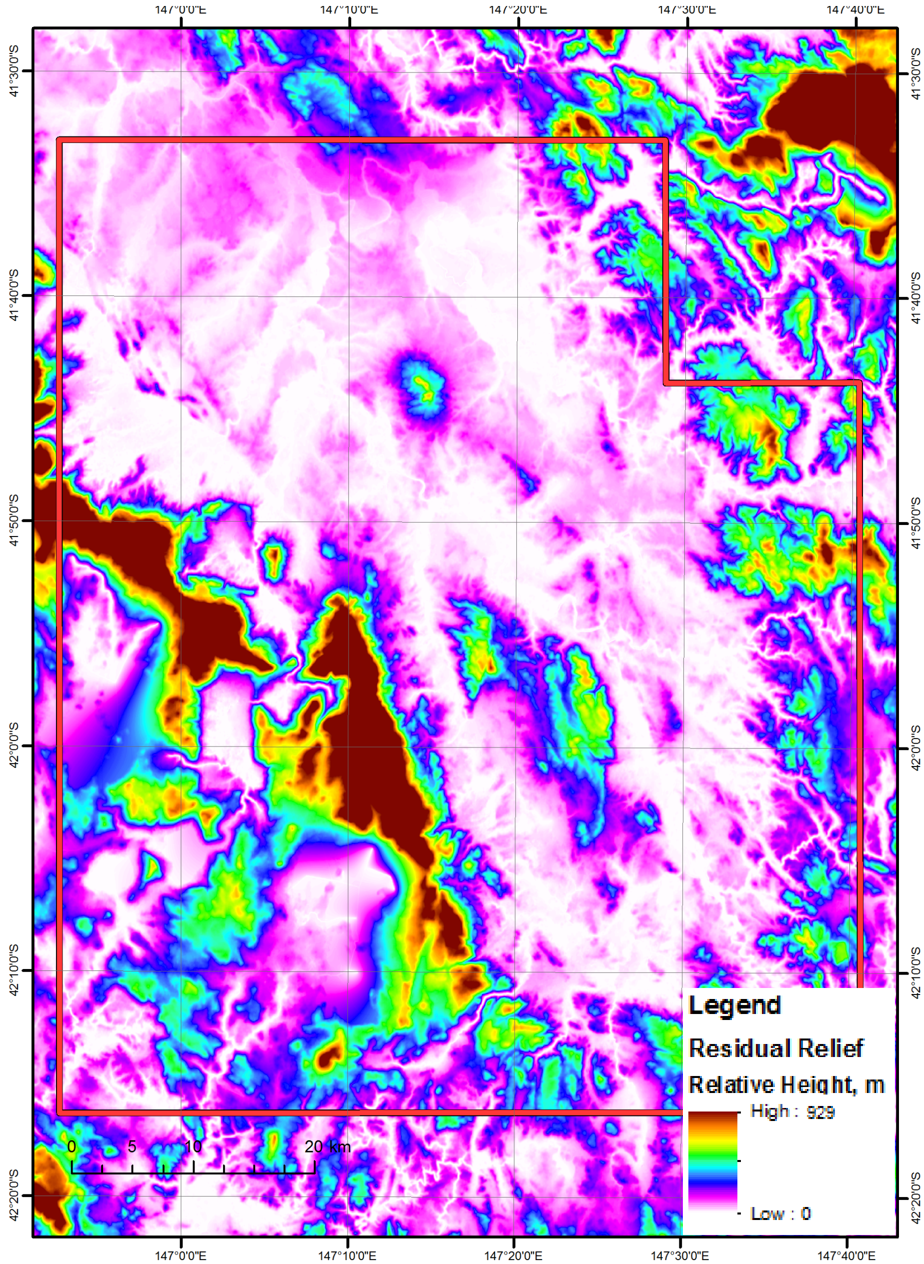


Figure 22: Residual Relief map corresponding to Base Level 5.

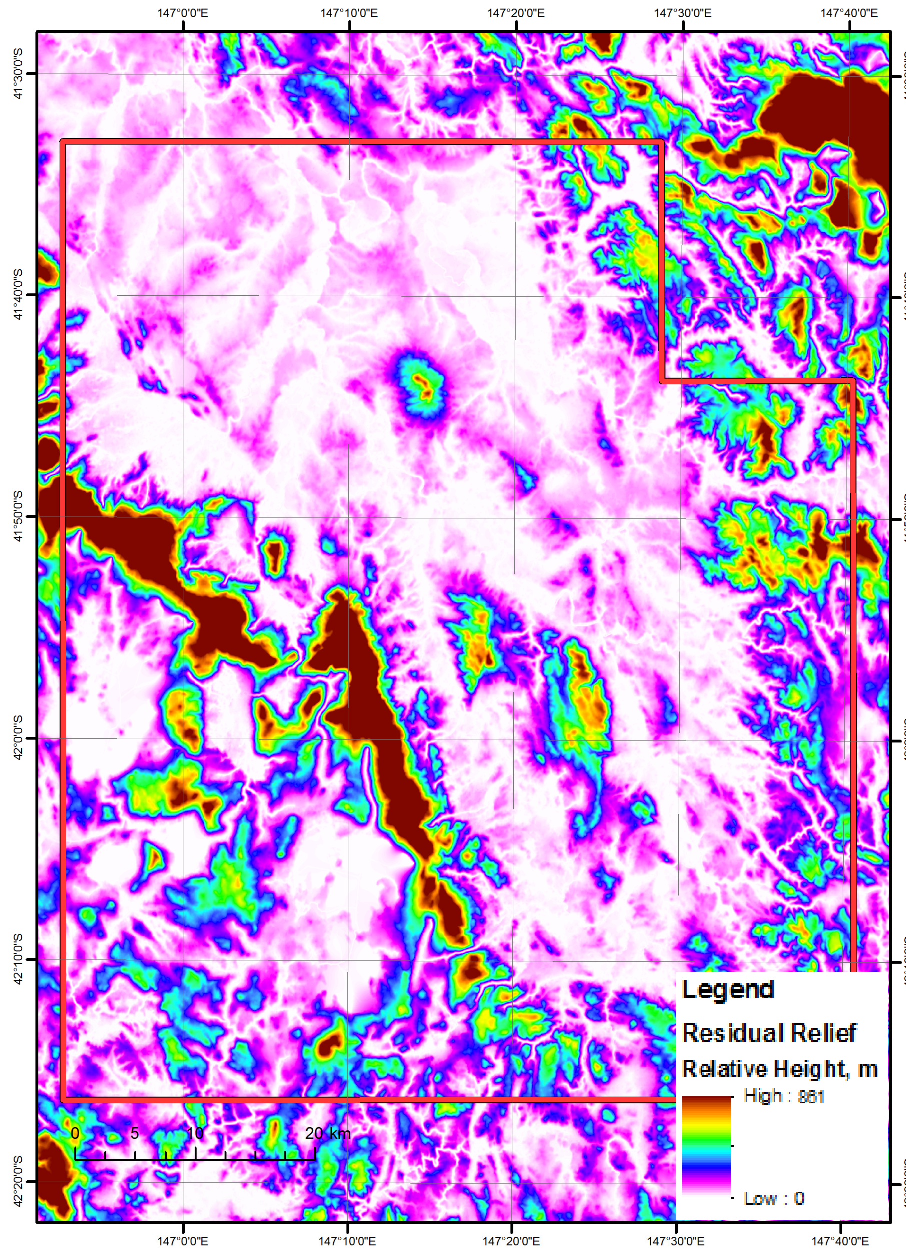


Figure 23: Residual Relief map corresponding to Base Level 4.

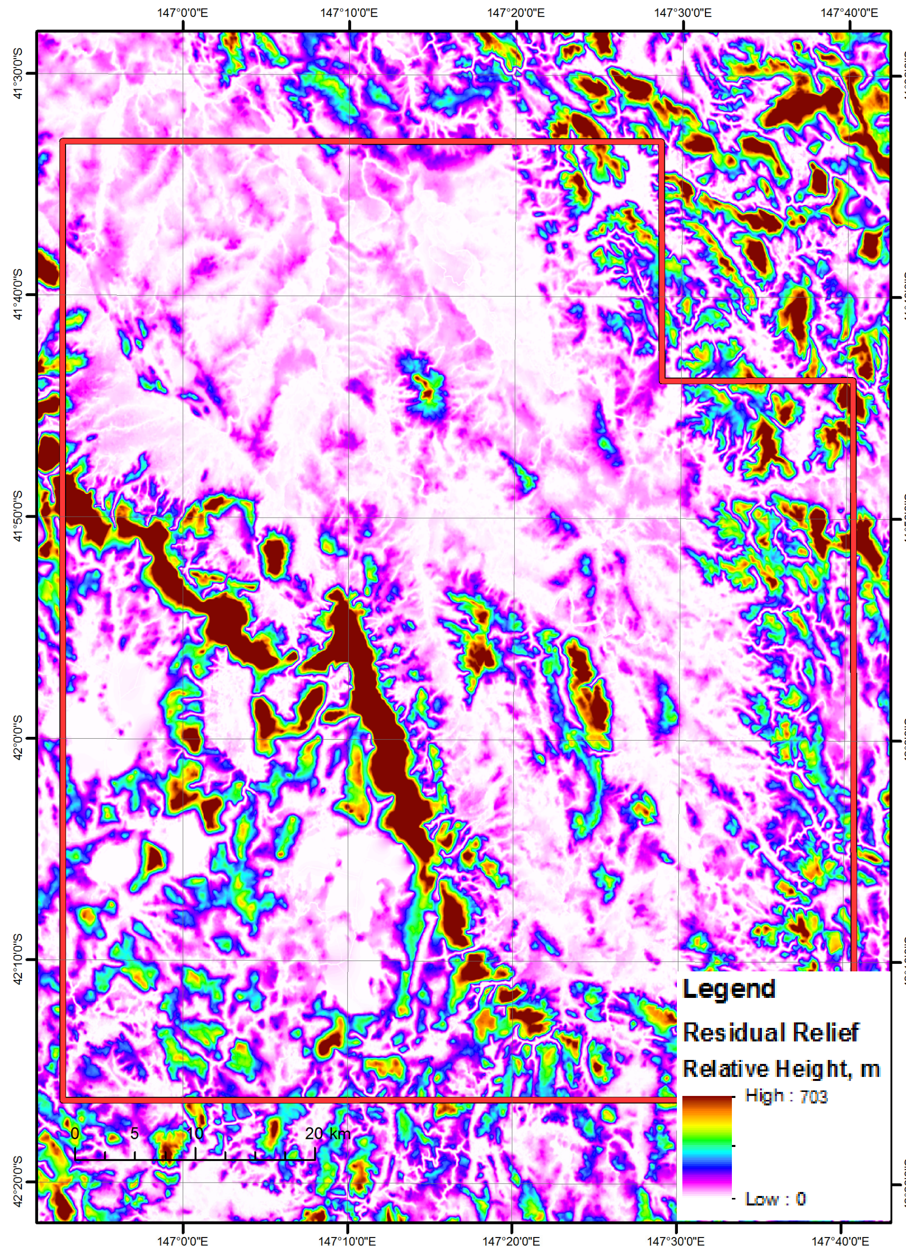


Figure 24: Residual Relief map corresponding to Base Level 3.

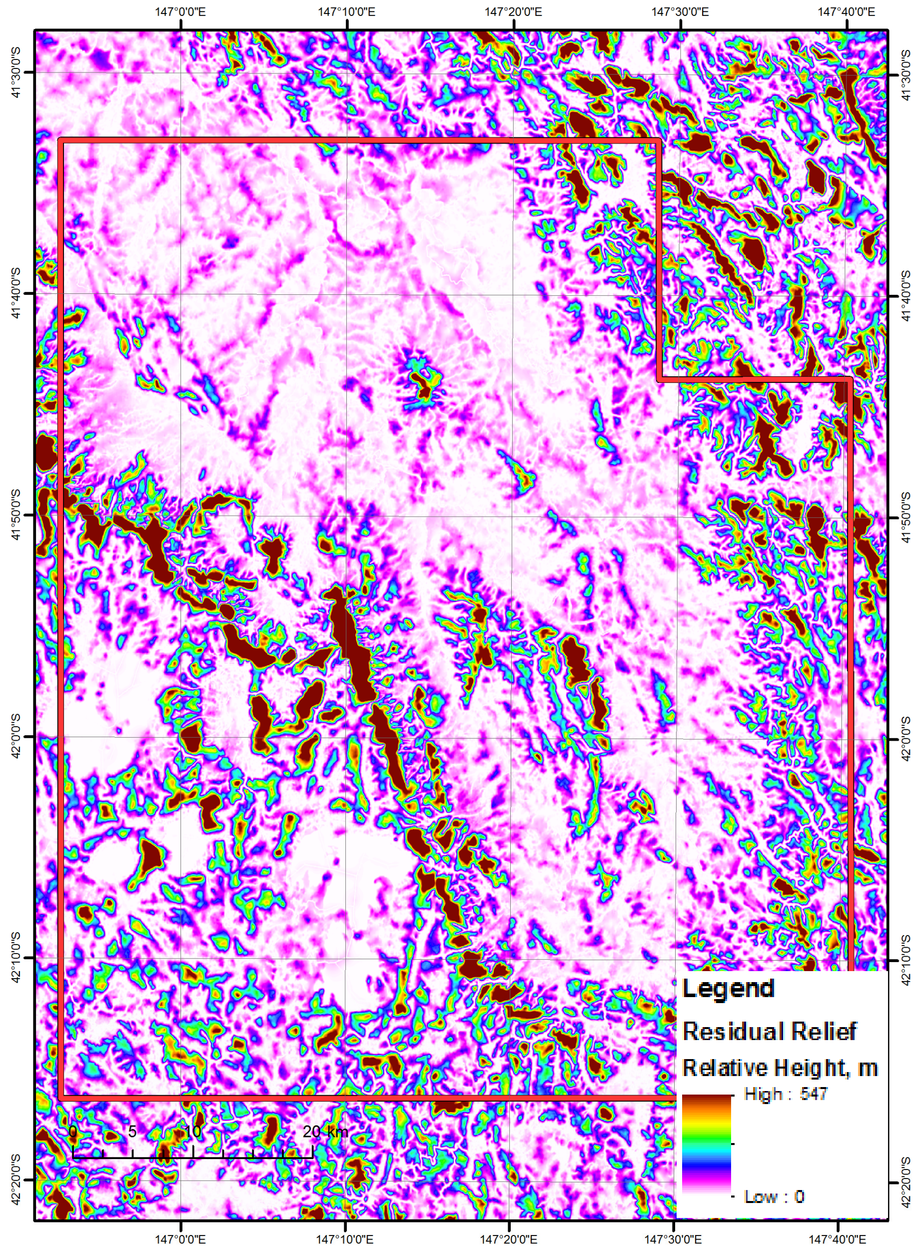


Figure 25: Residual Relief map corresponding to Base Level 2.

2.2.6 COMBINED ANALYSIS OF BASE LEVEL & RESIDUAL RELIEF MAPS

In order to confirm the existence of anticlines, a combined interpretation of residual relief and Base Level maps is required and provided in this report.

A combined interpretation of Base Level maps (isobase lines) and Residual Relief maps provides an opportunity to distinguish anticlinal structures. Potential anticlines can be distinguished on the aforementioned resulting maps based on the following two conditions: 1) thickening of isolines in a shape of a half-ellipse, horseshoe, loop, or «structural nose»; and 2) Local Residual Relief peaks coincide with the areas of thickening isobase lines and follow their "horseshoe-like" contours (described in item 1) as shown in **Figure 28**.

There are two major types of relief - direct and inverse. In direct relief, watersheds and anticlinal domes as well as river valleys and synclines coincide (**Figure 26**). Inverse relief works in reverse: river valleys are located above anticlinal domes, while watersheds correspond to synclines in the subsurface (**Figure 27**).

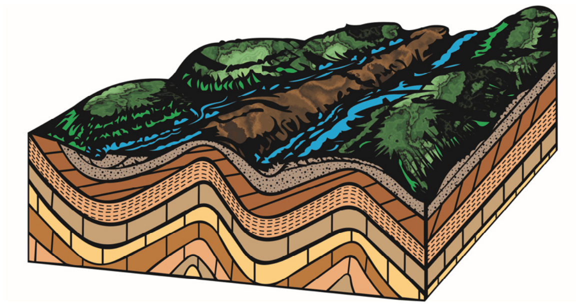


Figure 26: Example of direct relief.

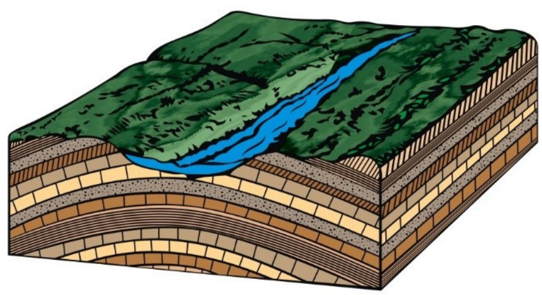


Figure 27: Example of inverse relief.

In situations, where local anticlines that are reflected in a direct relief, the residual relief does the following: 1. it forms small enclosed structures; 2. its elevations at the periphery of such structures have small oval small almost closed contours with the internal side almost certainly contouring the anticlinal dome.

In situations, where local anticlines that are reflected in an inverse relief, the residual relief does the following: 1. above the anticlines, its elevations are almost equal to background values; 2. at the periphery of anticlines, it is characterized by high, distinct local elevations in an almost closed-loop concentric shape of a concave that is turned towards the anticlinal dome.

Local anticlinal folds can be detected by combining Base Level and Residual Relief maps as shown in **Figure 28**.

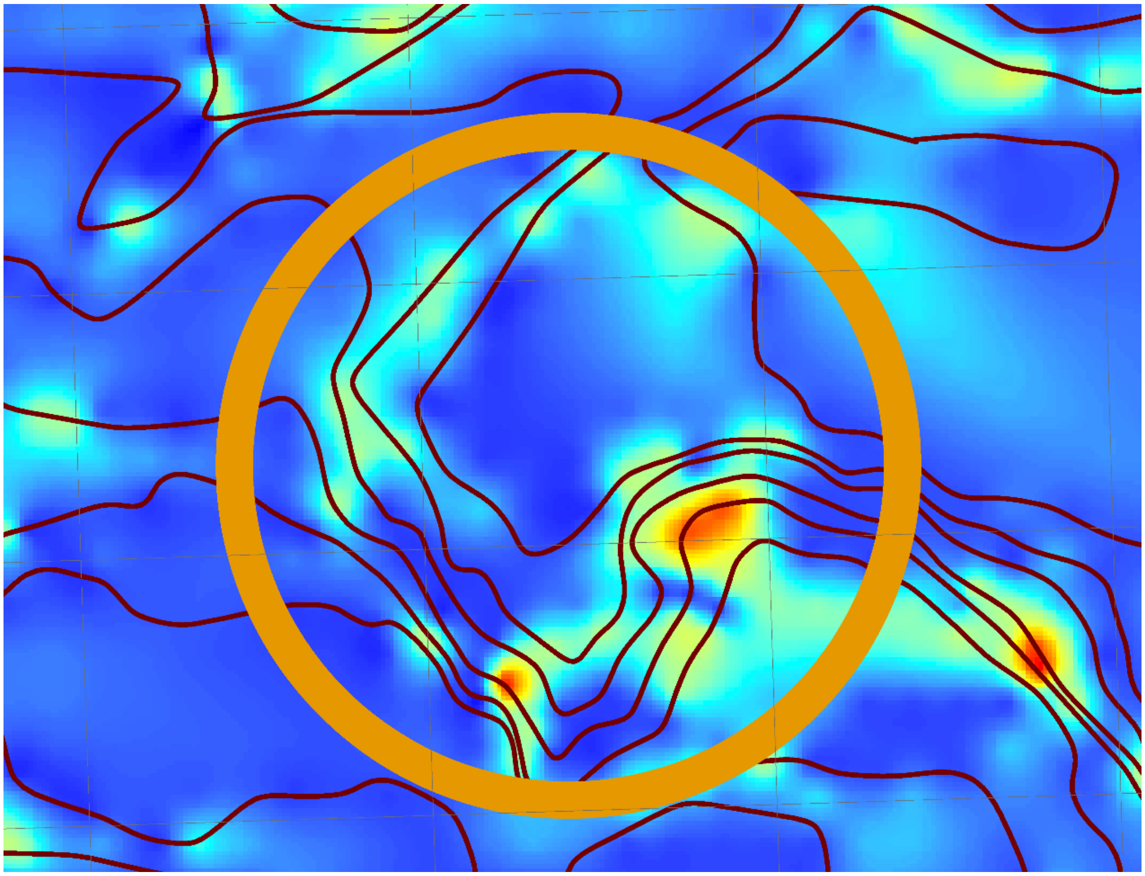


Figure 28: Example of revealing local tectonic structures.

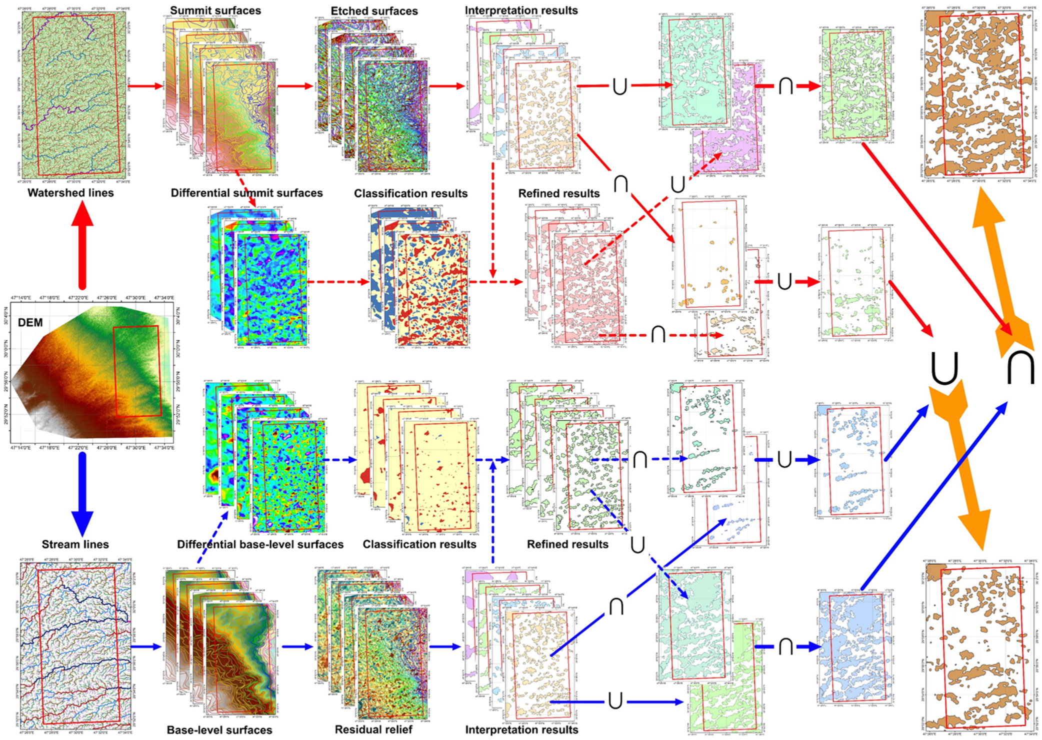


Figure 29: Workflow of the entire Morphometric Analysis process.

Figure 29 shows the entire process of Morphometric Analysis. The initial stages of creation of Streams and Watershed maps, as well as the creation of Base Levels, Summit Surfaces, Residual Relief, and Etched Surfaces have been completed. The Base Level and Residual Relief maps are presented in this report.

The entire process shown in **Figure 29** is expected to be completed in the first half of 2017, the result of which will be maps with contours of uplifts for each of the Base Levels shown herein.

2.3 RELIEF PLASTICITY OR PALEO-RECONSTRUCTION ANALISYS (PRA)

2.3.1 INTRODUCTION

The method of paleo-reconstruction (PRA) allows performing certain paleo reconstructions of the lithodynamic situation within AOI. The HC-prospectivity prognosis will be made based on the identified flow structures and the distribution of geological material according to the method's criteria. PRA of maps of flows of geological matter (or simply "flows") studies several HC-prospectivity criteria:

1. Linear and circular faults/features;
2. Paleodeltas;
3. Areas of the lithological mass distribution that manifest themselves in the gravitational field of the Earth;
4. Contact zones of independent flow systems;

5. Zones of attraction, such as depocenters and depressions;
6. Genetic dependency between HC systems within same flow systems;
7. Layer-by-layer overlay, as a positive superposition, of HC prospectivity the aforementioned HC-prospectivity criteria;
8. Positive superposition of HC-prospectivity areas derived via PRA at different scale.

2.3.2 STAGES OF WORK

The work program consists of four stages of cartographic and analytical activities:

1. Identification and analysis of lithodynamic flow structures based on the existing structure and depth maps (4 to 2.5 km and from 1 to 2.5 km) at the scale 1: 2,500,000. Preparation of a regional prognosis.

2. Conversion of the existing (porovided by customer) isolines map of the gravitational field and its further interpretation at the scale 1: 2,500,000. Comparison of the obtained data with the positions of productive fields.

3. Development of the PRA map of the surface using at 1:100,000. Identification of tectonic structures (linear and circular faults), paleodeltas, and areas of accumulation as prescribed in the previous section.

4. Identification and analysis (similar to item 3) of lithodynamic flow structures within AOI using maps of Base Levels for the relevant levels.

2.3.3 IDENTIFICATION AND ANALYSIS OF FLOW STRUCTURES AT 1: 5,000

In order to have a general understanding of the lithodynamic situation of the entire region, horizons of varying depths are being analyzed, including the present-day surface. The scale of this stage of these maps is 1:5,000,000. Despite the generalized nature of the data at such a scale, the method of PRA allows seeing main geological features of the region and the reasons for regional HC-prospectivity of certain areas.

The main PRA features described in the Introduction sub-section of PRA (circular anomalies, accumulation zones, etc.) are being identified using these low-scale maps.

Based on DEM and topographic maps of Tasmania, we identified flows (**Figure 30**) of the region. Positive flows on this map are shades of brown. Flow structures and flow systems of the region are shown in **Figure 31**.

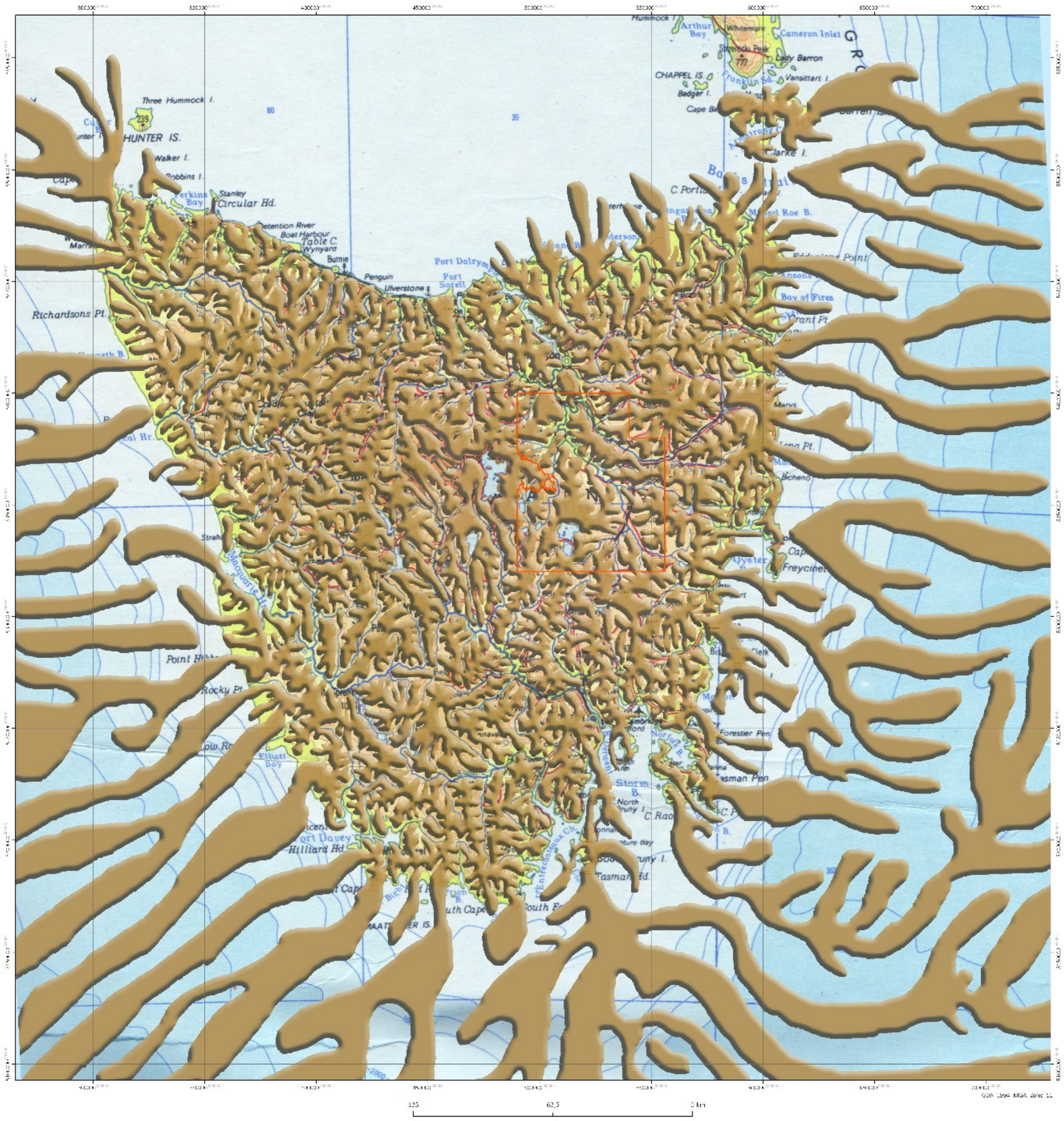


Figure 30: Map of lithodynamic flows of Tasmania. Scale 1:5,000,000.

It should be noted that the analysis of such small-scale maps reveals deep lithodynamic structures and systems. At this scale, local surface landforms do not play any significant role. Thus, the relief plasticity method reveals structures that formed long before the current morphology. These structures may appear on the surface as outliers, although the visual information about them is not sufficient to recreate the overall picture of the geological and tectonic development of the region.

Figure 31 shows the lithodynamic situation of Tasmania, where the AOI is situated on one major flow system (the positive lithodynamic flows/convexities are shown in blue), while the area of former EL14 is shared by two lythodynamic flow systems that are not genetically connected.

All of this information, as well as the information at other scales will be analyzed in connection with potential depocenters and directions of migration of HC's.

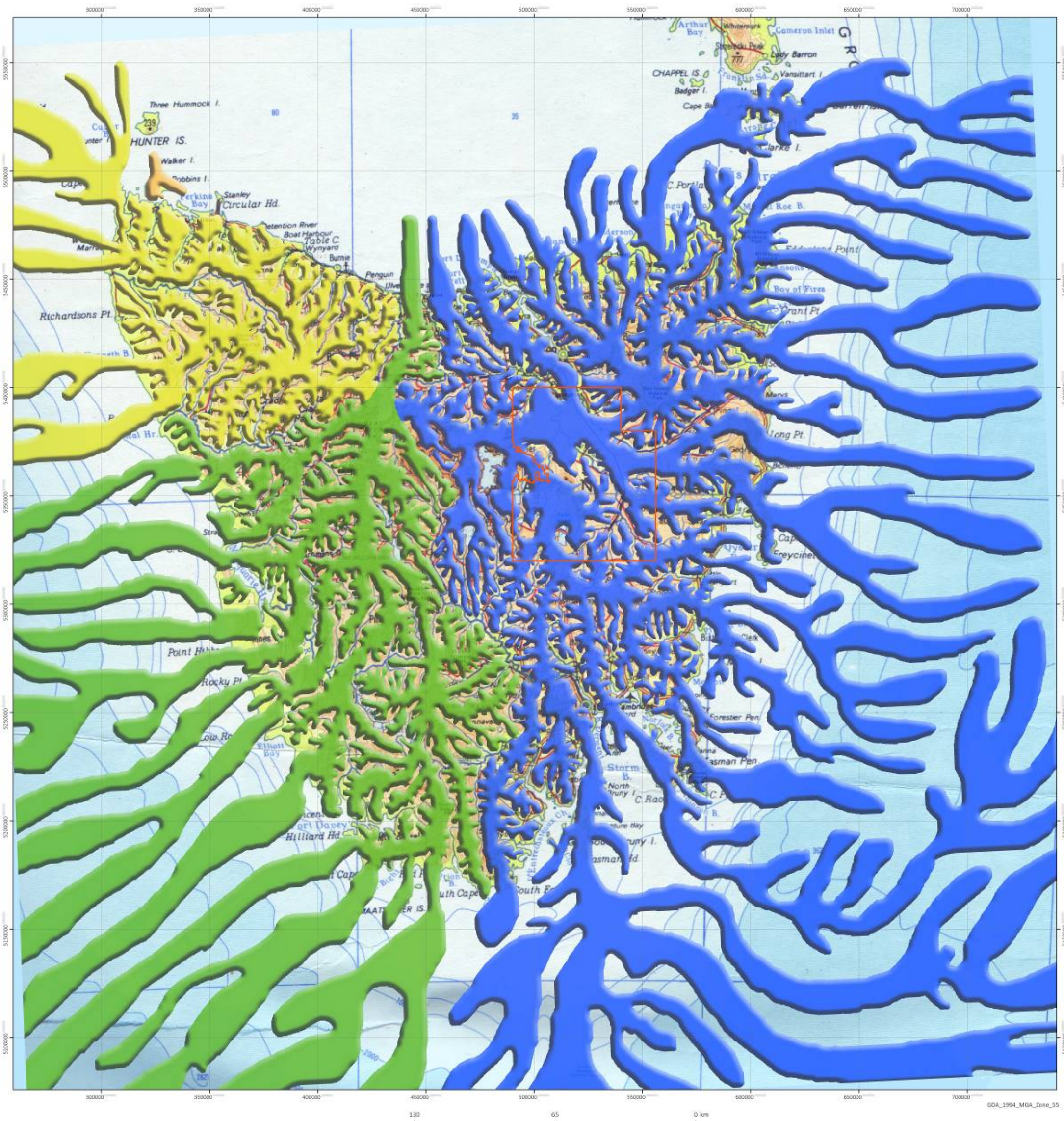


Figure 31: Map of lithodynamic flow systems of Tasmania. Scale 1:5,000,000.

2.3.4 PRA SUMMARY

Regional PRA is in progress. The following scales and Base Levels are planned to be processed using PRA:

- Surface – 1:5,000,000 and 1:100,000. The small-scale analysis was aimed at understanding the main patterns of transfer of the geomedium and assessing the possibility of deep HC potential within AOI;
- Base Level II – 1:10,000; identification of zones of HC prospectivity for the relevant horizon;
- Base Level III – 1:10,000; identification of zones of HC prospectivity for the relevant horizon;
- Base Level IV – 1:10,000; identification of zones of HC prospectivity for the relevant horizon.

PRA of all aforementioned levels and scales will examine the following HC prospectivity criteria:

- Paleo-flows;
- Deltaic structures;
- Zones of contact of flow systems;
- Depocenters;
- Circular structures;
- Lineaments.

2.4 STRUCTUREMETRIC ANALYSIS (SMA)

SMA assessment of the oil and gas prospects of the unexplored territories includes the following activities:

1. Development of a scheme stress fields at one of several regional scales.
2. Paleo-structural analysis of the development of the HC basin.
3. Preparation of a regional structure-formational scheme based on the interpretation of the stress field data and SMA of satellite images at the scale of 1:100,000 - 1:50,000.
4. SMA of the areas selected for a detailed study; determination of the depth of productive horizons at the scale of 1:10,000;
5. Development of vertical structuremetric cross sections.

2.4.1 MAPPING STRESS FIELDS

The scheme of stress fields is shown in **Figure 32**. It is based on the processing of multispectral satellite data using the SMA criteria for identification of the key elements of deformation of the sedimentary cover and the basement. Based on the data obtained, the vector diagram of stress fields was built; it is a projection of the plicate and disjunctive dislocations of the HC saturated strata on the surface. Stress vectors shown in **Figure 32** are the zones of maximum stress, many of which also indicate the movement/shift direction of tectonic blocks.

The map of stress fields reflects the change of density properties of geological objects; and the borders separate the geological formations with varying acoustic density. The SMA interpretation of stress fields helps establish the nature of geological formations, the history of the oil basin, and the areas of most likely hydrocarbon accumulations.

The scheme of stress fields in **Figure 33** is work in progress of mapping of stress fields based on the scale of 1:25,000 that are expected to render HC prospects and local structures at the later stage of the project.

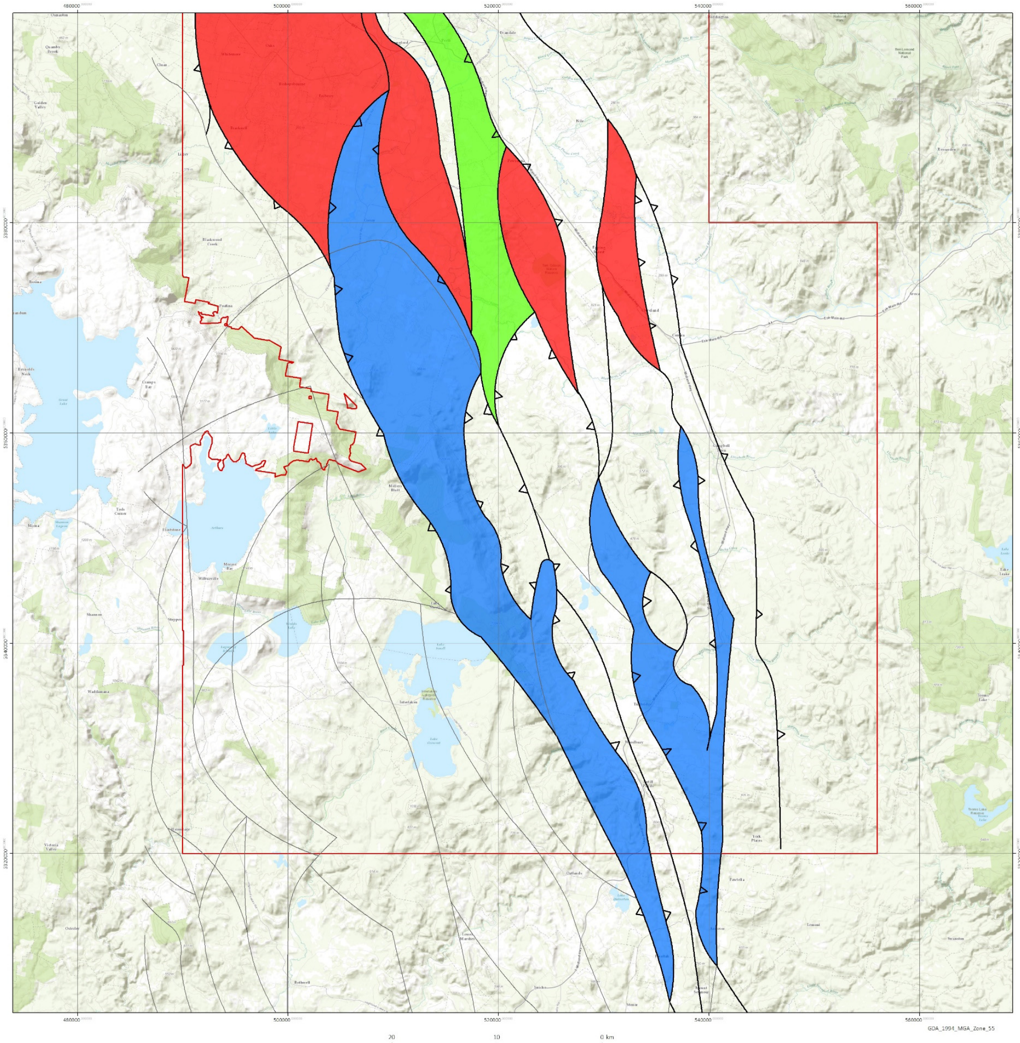


Figure 32: Regional mapping of stress fields.

1(black and gray lines) – lines of major and minor stress fields; 2(red zone) – zone of HC prospectivity of priority 1; 3(green zone) – zone of HC prospectivity of priority 2; 2(blue zone) – zone of HC prospectivity of priority 3.

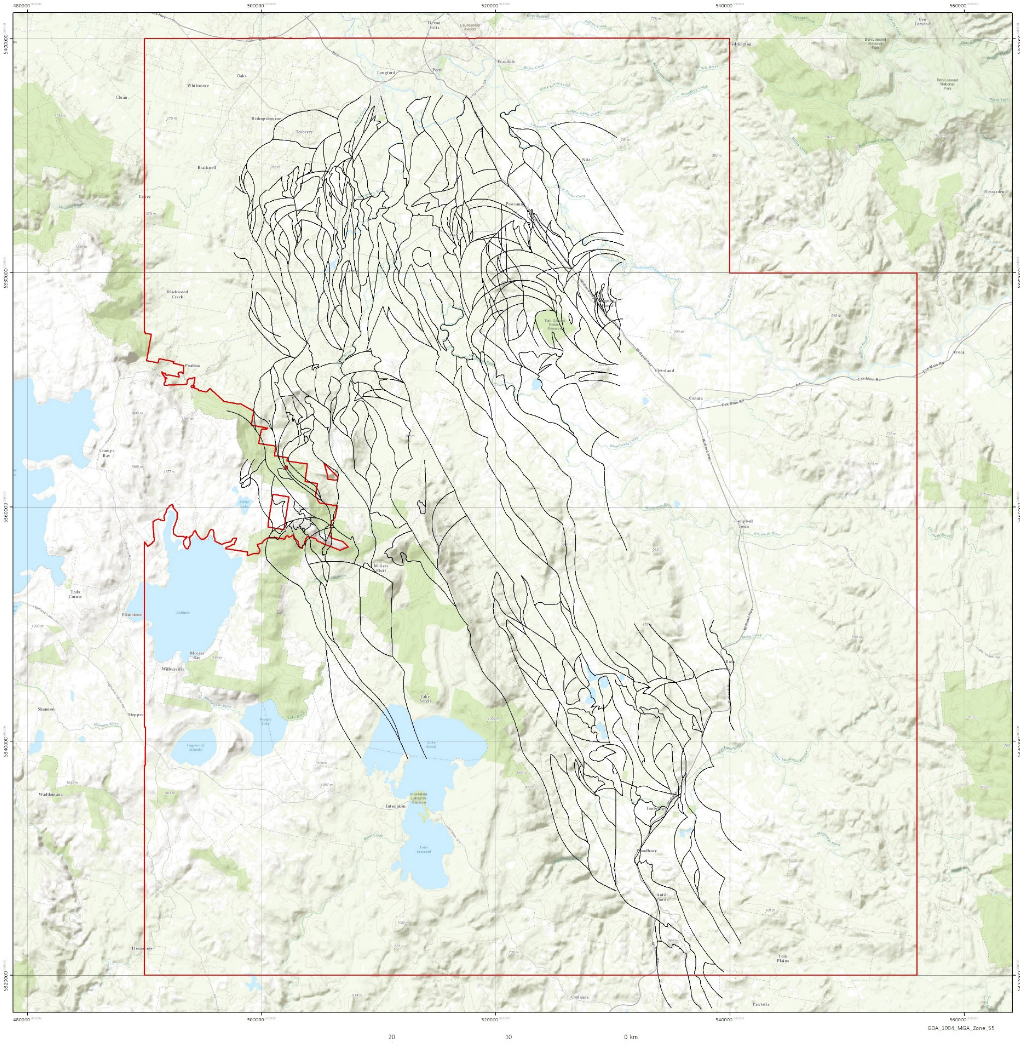


Figure 33: Local mapping of stress fields.

1(black lines) – lines of stress fields delineated within the regional HC trend shown above.

The regional part of Structuremetric Analysis is under way. In addition to the delineation of the potential HC trend and priority zones of prospectivity, this part of the survey is expected to perform paleo-reconstructions of the relevant phases of development of the sedimentary environment.

Upon the interpretation of the regional results and the delineation of local-scale stress fields, local zones of HC prospectivity will be delineated as the product of this phase of STeP.

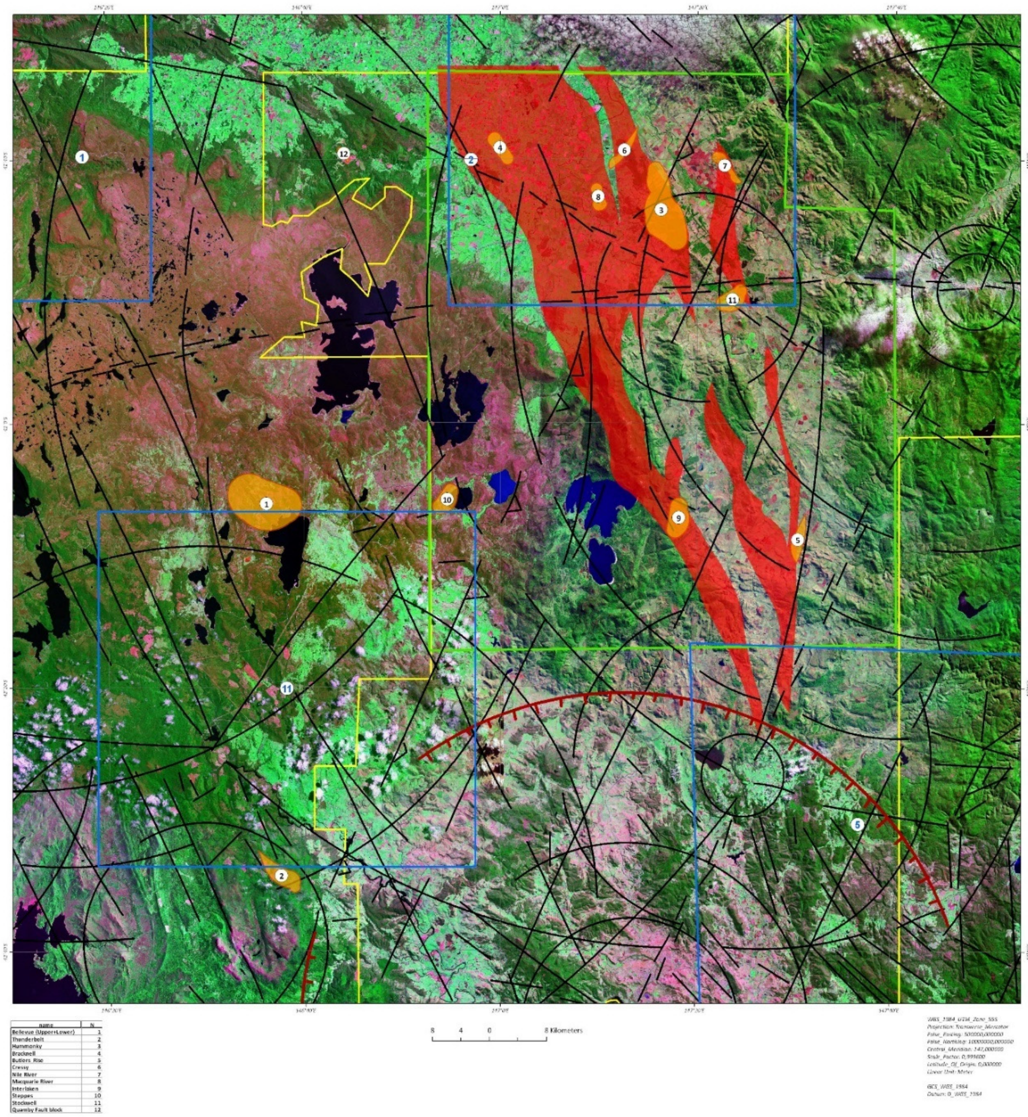


Figure 34: Superposition of Structuremetric analysis and geodynamic analysis

Red areas – SMA leads; Black lines – GDA constructs; Orange areas – seismic leads.

3. APPENDIXES

3.1 MINERAL INDEXES STUDY

The Mineral Indexes study is being carried out for varying indexes. For example: Mineral Composites are useful for lithological discrimination of the territory. Hydrothermal Composites are suitable for expression of alteration zones. While this study does not impact the findings related to HCs directly, as compared to the other types of STeP research provided herein, this data is useful at the stage of integration, geological interpretation, as well as an input for artificial neural network calculations.

3.1.1 PROCESSINS

Standard algorithms for satellite images processing were used:

- Atmospheric correction – for removing atmospheric distortion;
- Radiometric correction - conversion of the digital numbers to a real reflection coefficient;
- Histogram matching - to normalize satellites images.

Table 1: Technical Specification Landsat 8 (OLI/TIRS).

Spectral bands of Landsat Landsat-8 (OLI/TIRS)	Wavelength, µm	RGB color model
Band 1 - (Coastal)	0.433-0.53	
Band 2 - (Blue)	0.45-0.515	
Band 3 - (Green)	0.525-0.6	B*
Band 4 - (Red)	0.63-0.68	
Band 5 – (MIR)	0.845-0.885	G*
Band 6 - (SWIR1)	1.56-1.66	
Band 7 - (SWIR2)	2.1 -2.3	R*
Band 8 - (PAN)	0.50-0.68	
Band 9 – (Cirrus, SWIR)	1.36-1.39	
Band 10 - (TIR1)	10.30-11.30	
Band 11 - (TIR2)	11.5-12.50	
	*RGB composite shown below	

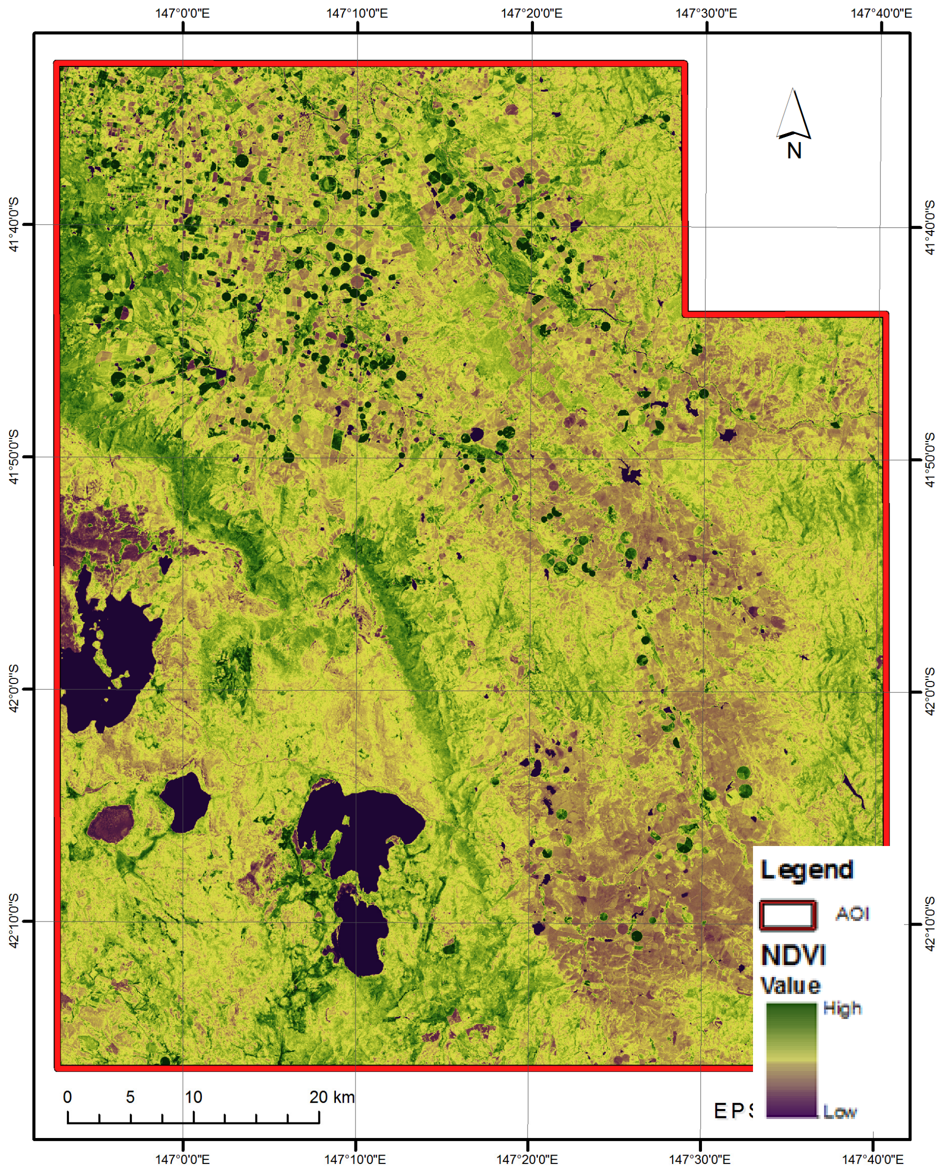


Figure 35: NDVI.

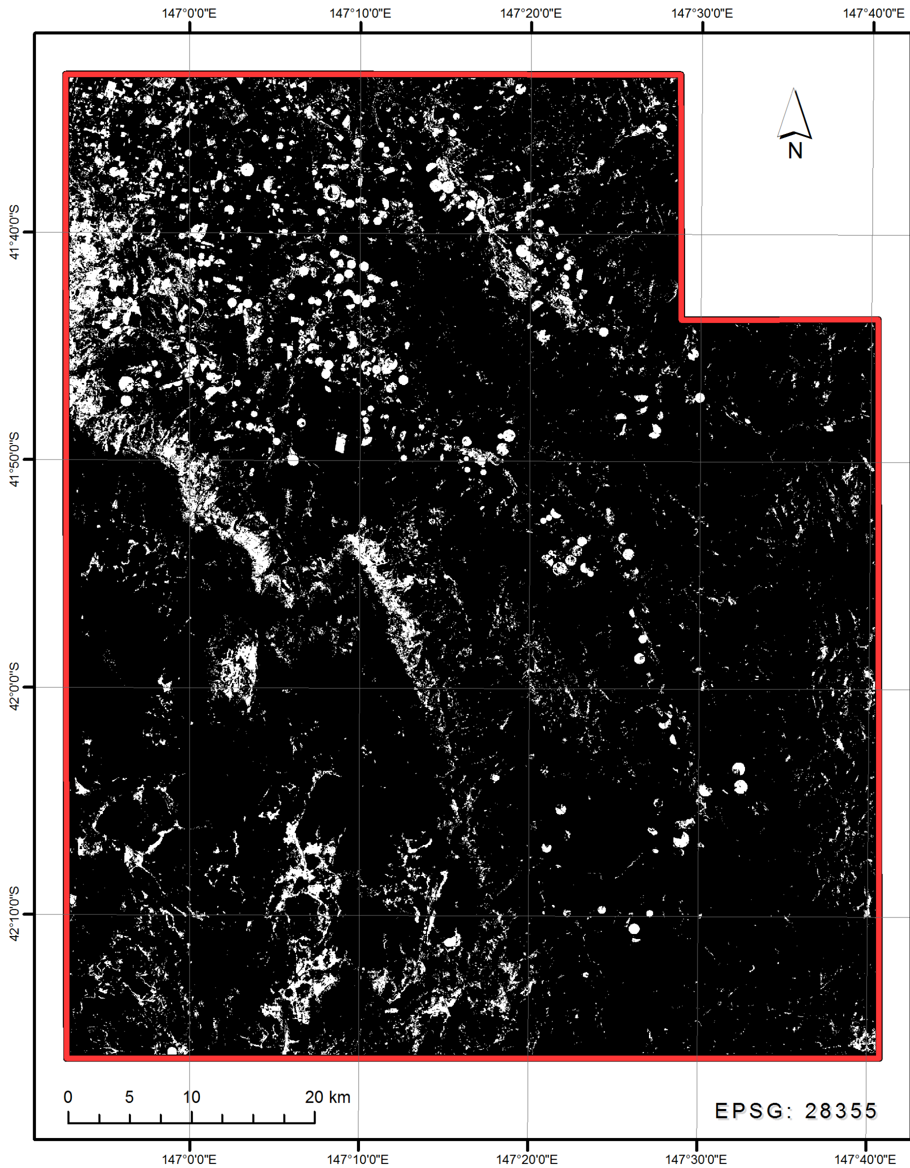


Figure 36: NDVI Mask.

3.1.2 GOSSAN

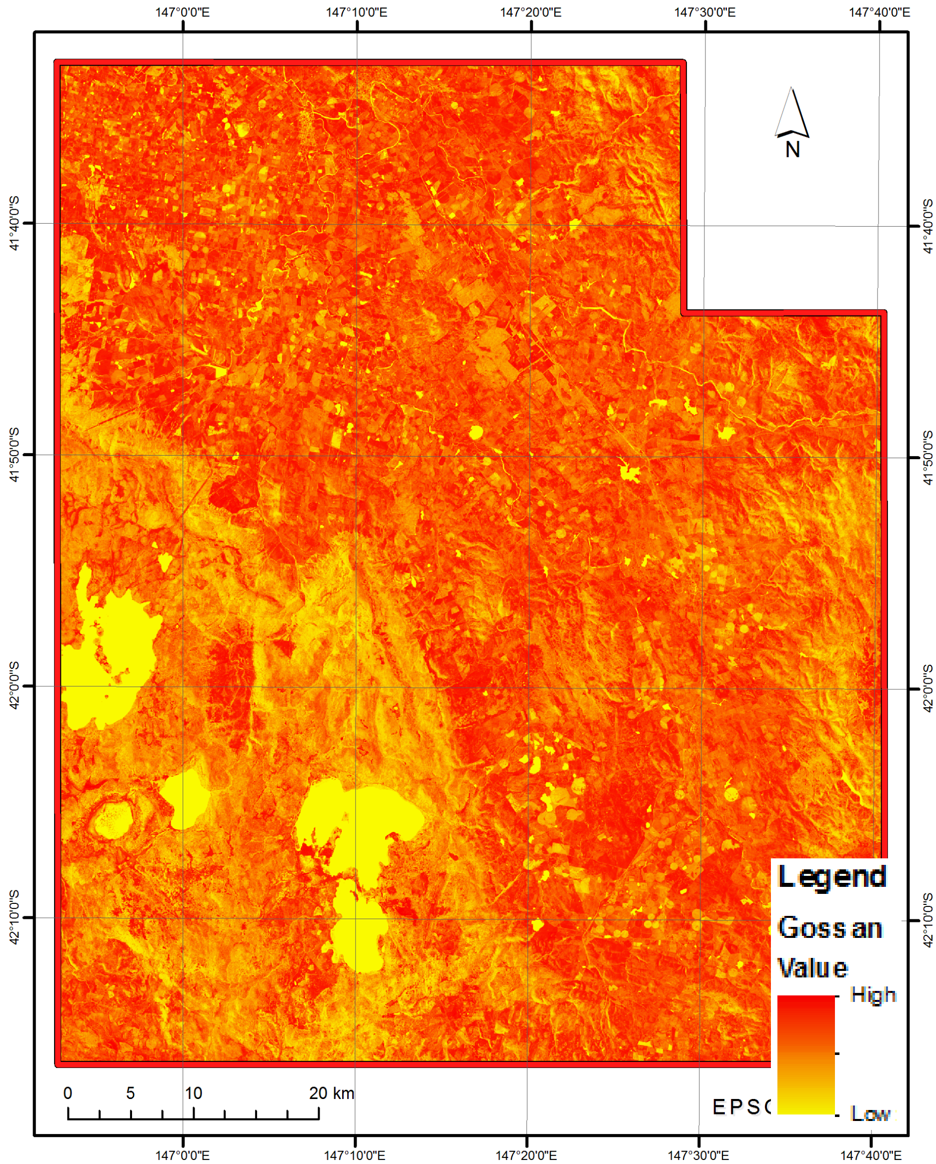


Figure 37: Gossan content.

3.1.3 LATERITE

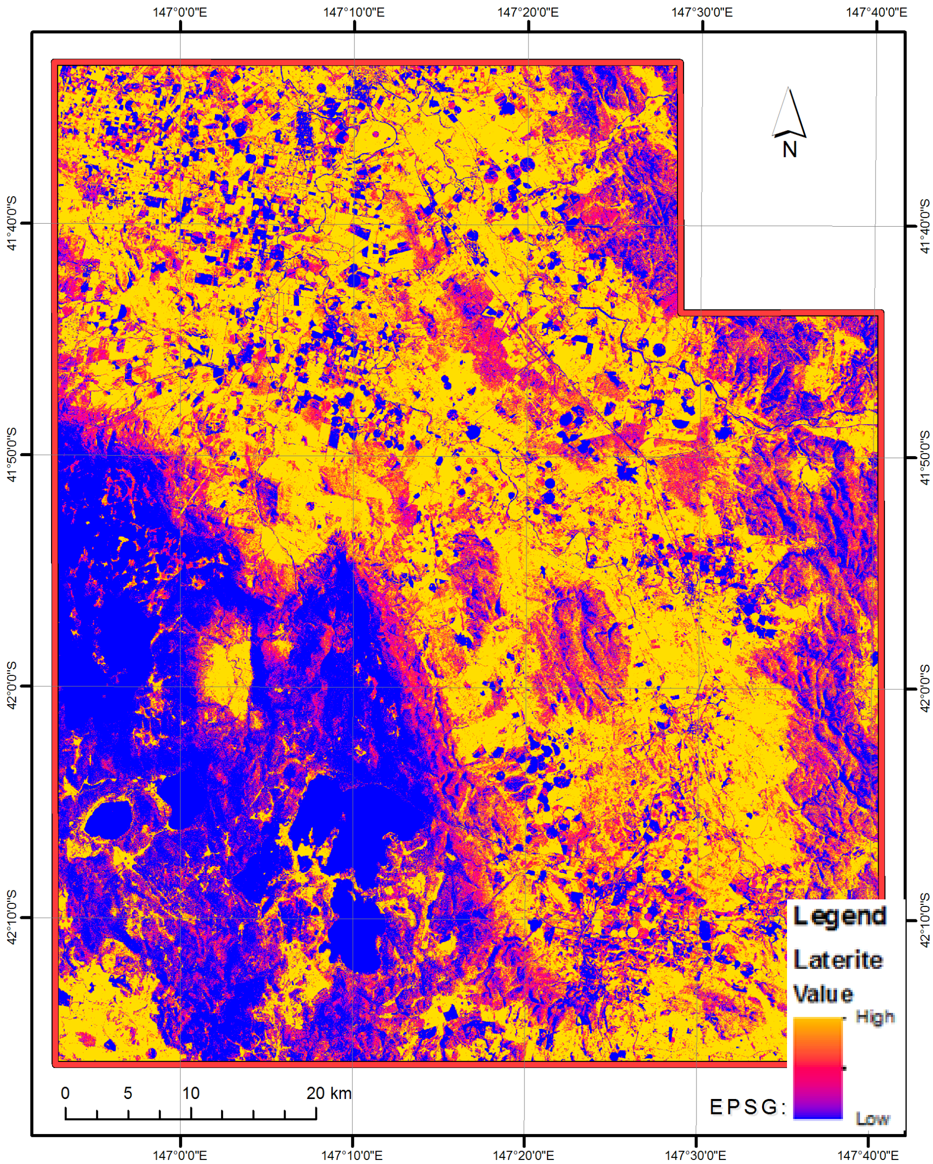


Figure 38: Laterite content.

3.1.4 MOISTURE STRESS INDEX

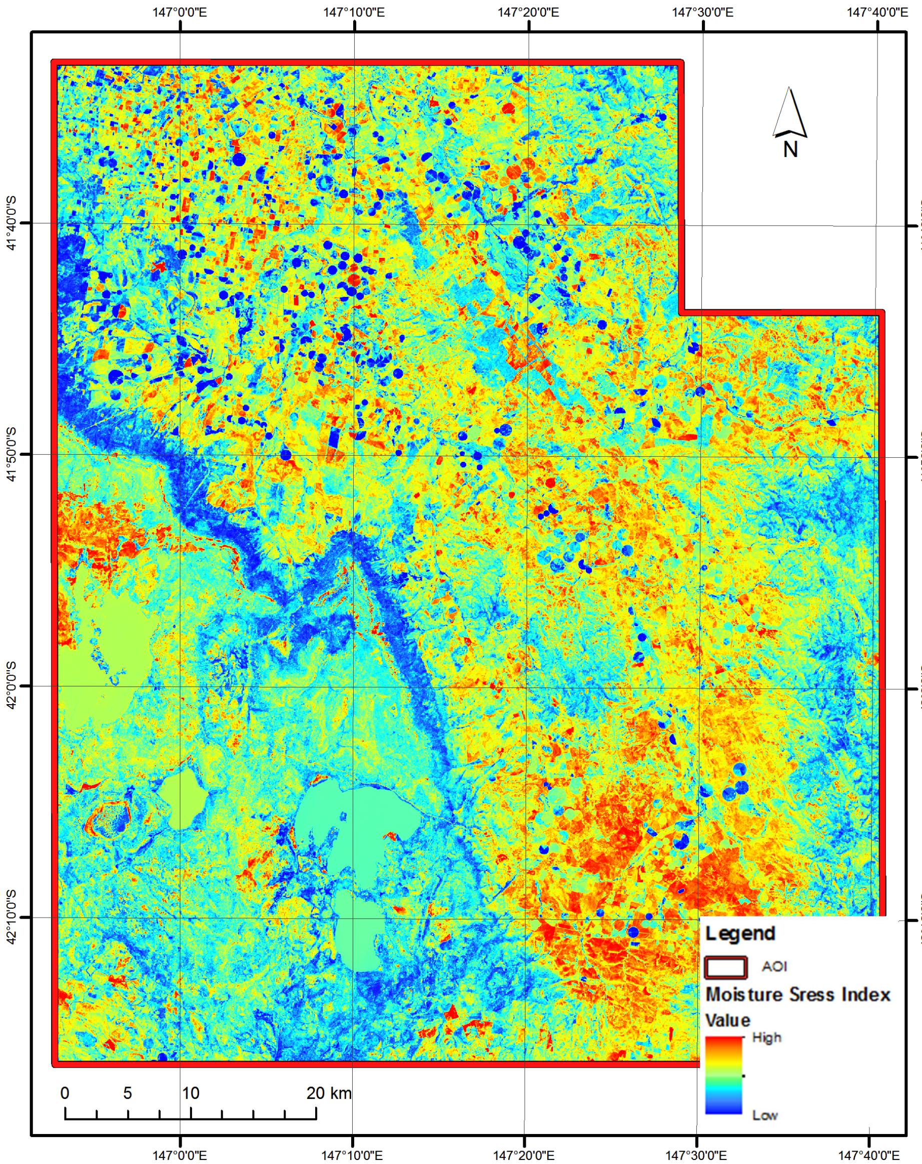


Figure 39: Moisture Stress Index.

3.1.5 CLAY, CARBONATE, PHYLLOSILICATE MINERAL CONTENT

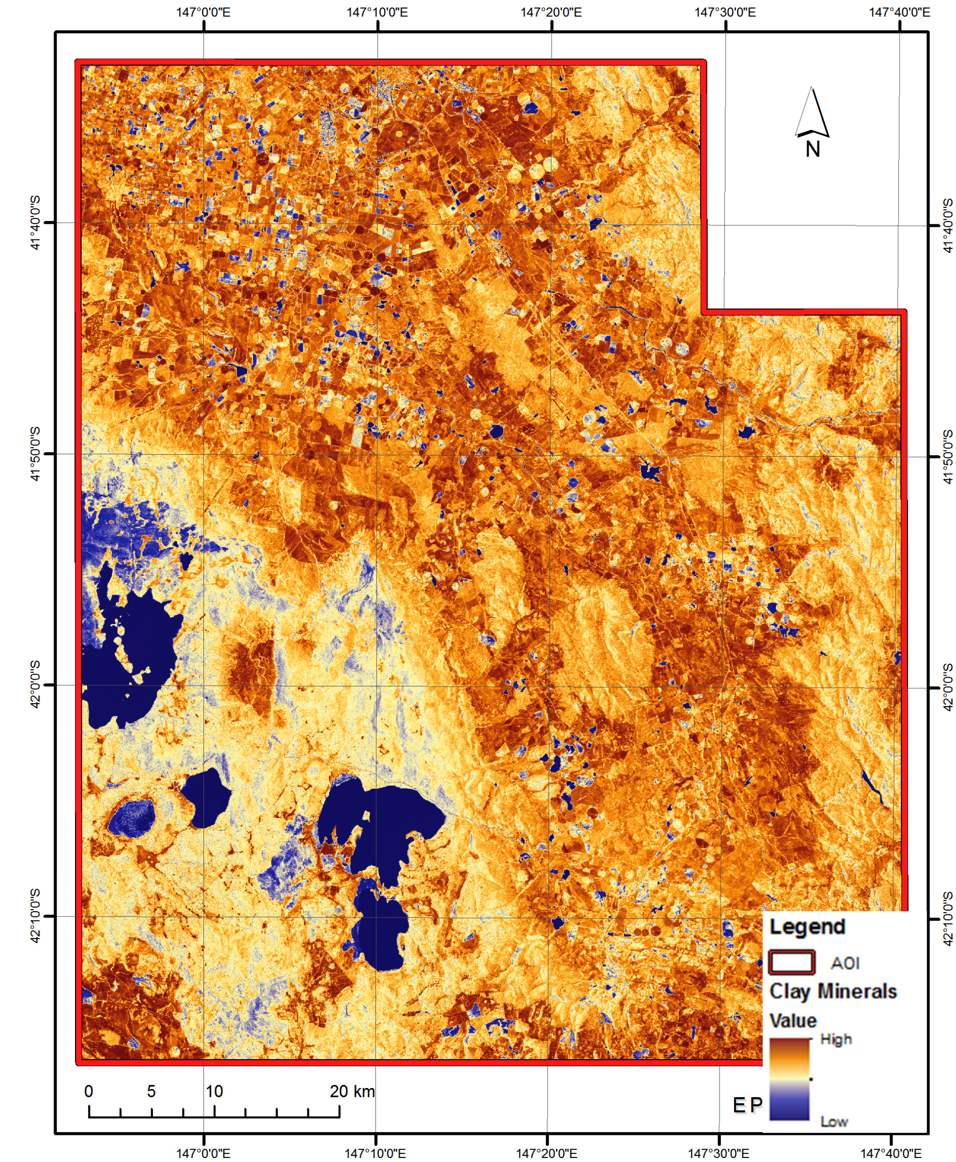


Figure 40: Clay minerals concentration; clay mineral = Band6/band7.

Varieties of the Mg-OH phyllosilicate mineral can be highlighted by the 6/7 ratio, especially when the abundance of the mineral has been enriched by alteration and (or) metamorphic processes, typically in ultramafic rocks.

Dolomitic marbles can be identified using the 6/7 ratio. In areas where no phyllosilicates, sulfates, or amphiboles with deep band 7 absorption exist, the 6/7 ratio may highlight the CEC (cation-exchange capacity) mineral group even in the absence of recrystallization or other enrichment.

Useful for identifying clayey soils and alteration zones rich in clay that are commonly associated with economic mineral deposits.

3.1.6 IRON OXIDE MINERAL CONTENT

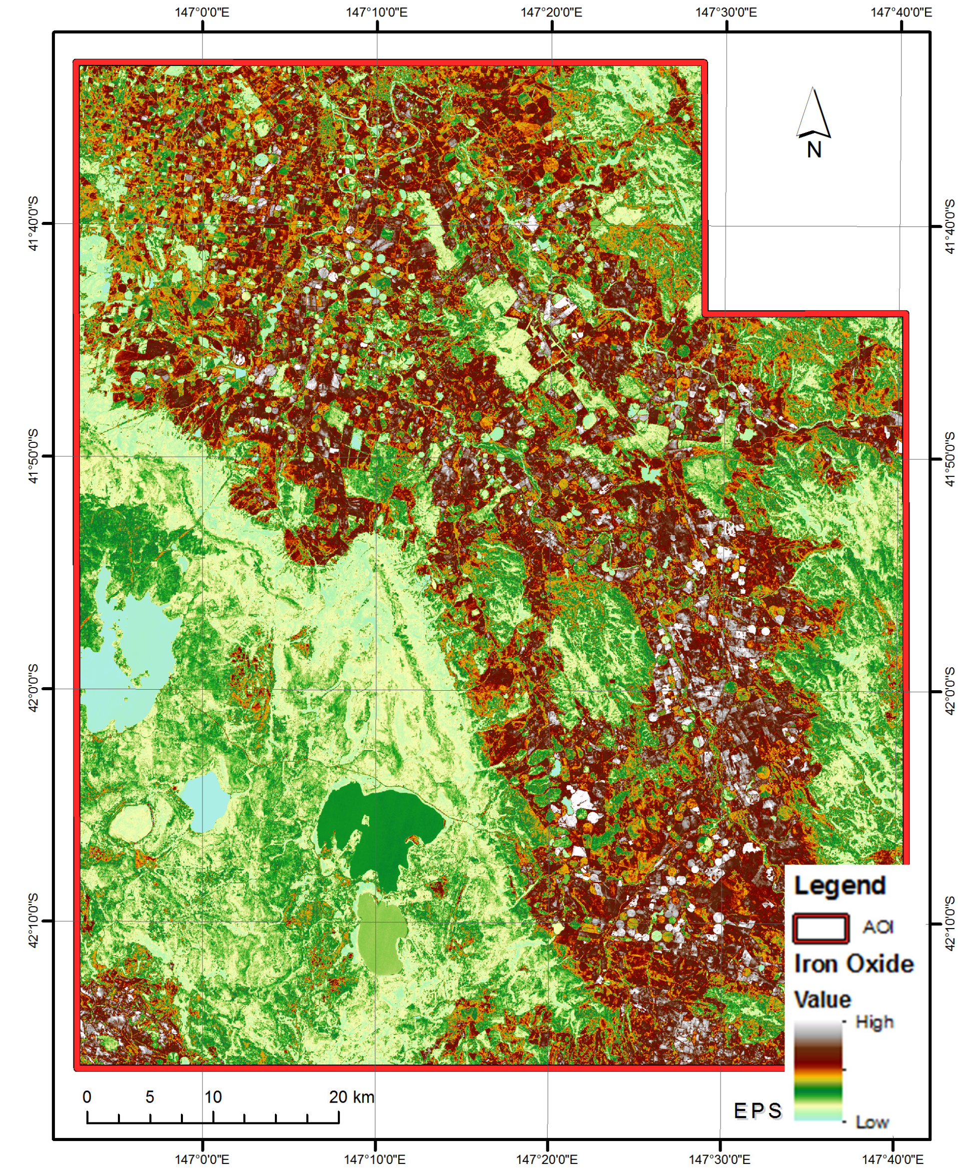


Figure 41: Iron oxide minerals concentration; iron oxide=Band4/band2.

This index will highlight areas in which any ferric iron **(Fe^{+3})** mineral (including jarosite, goethite, and hematite) occurs pervasively or as coatings. Ferric iron-bearing surfaces of hydrothermally altered rocks, sedimentary rocks such as red beds and arkoses, metamorphic rocks containing weathered, iron-bearing mafic minerals such as hornblende and biotite, sand deposits, and alluvium derived from such rocks will be identified with this index. The index is sensitive to ferric iron even in low concentrations.

3.1.7 FERROUS MINERALS CONTENT

Ferrous iron **(Fe^{+2})** produces ratio was used to highlight areas with this spectral shape. Propylitic alteration is the mineral most commonly identified using this index.

This index also highlights concentrations of coarse-grained ferric iron as exhibited by the spectrum of hematite. Hematite-bearing oxidized basalts on cinder cones in young volcanic fields will typically be identified using this index. Coarse-grained goethite will also be highlighted.

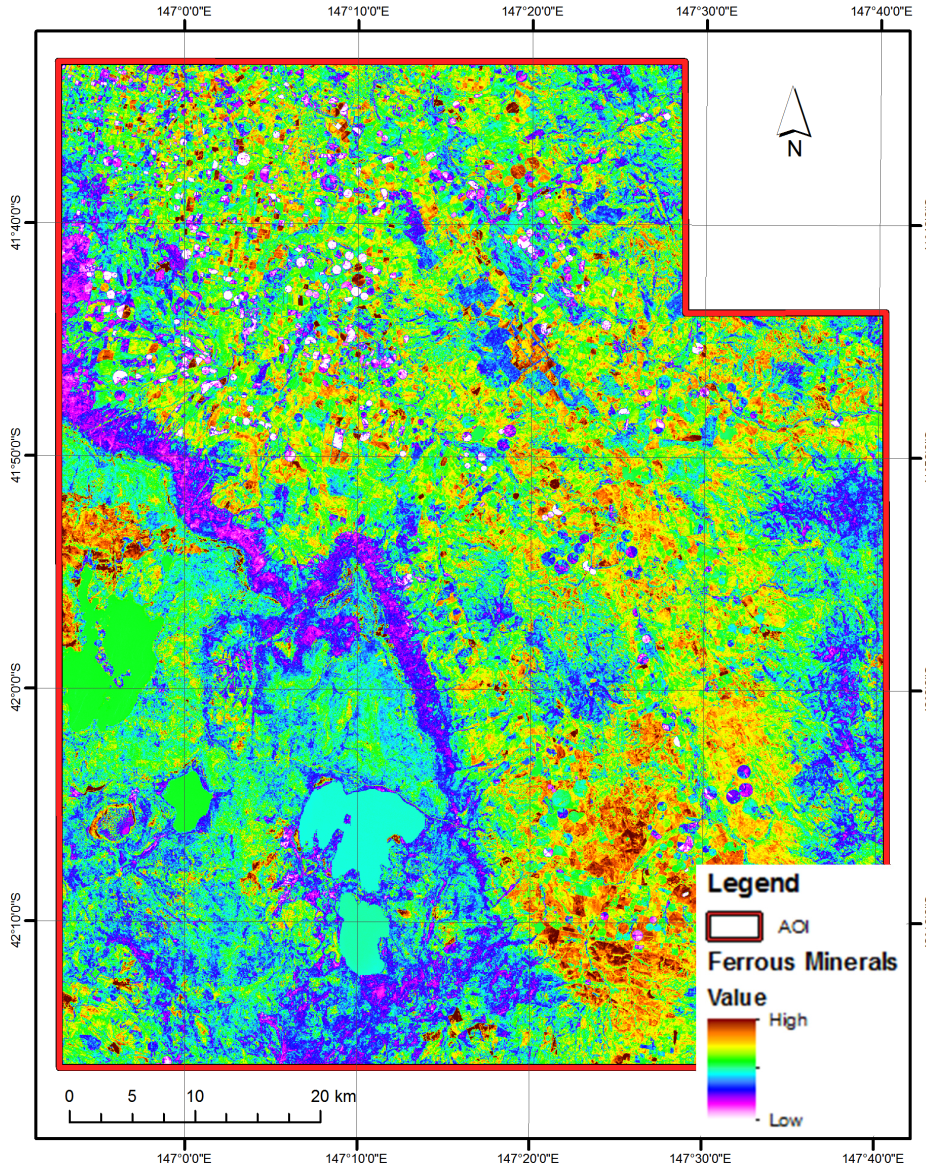


Figure 42: Ferrous minerals concentration; ferrous mineral = Band6/band5.

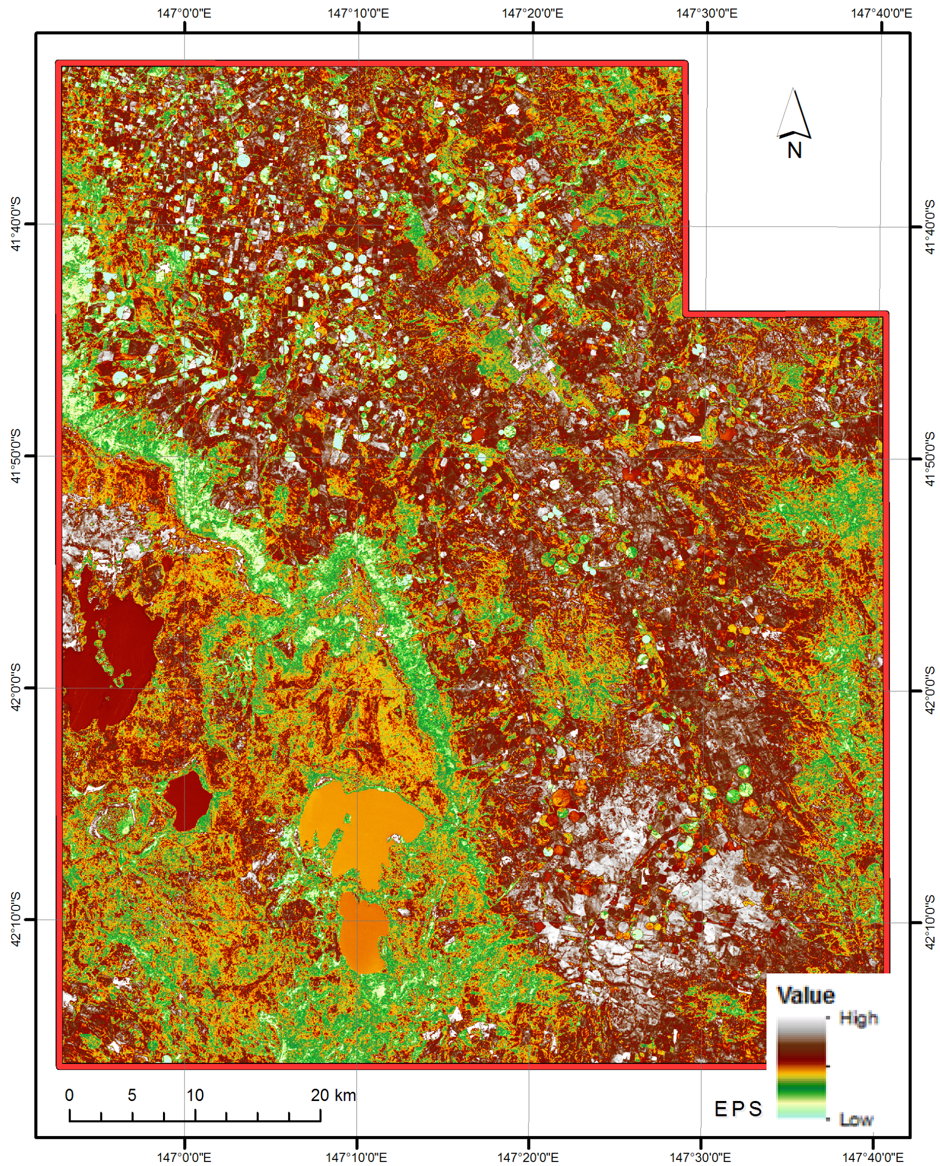


Figure 43: Ferric oxode concentration.

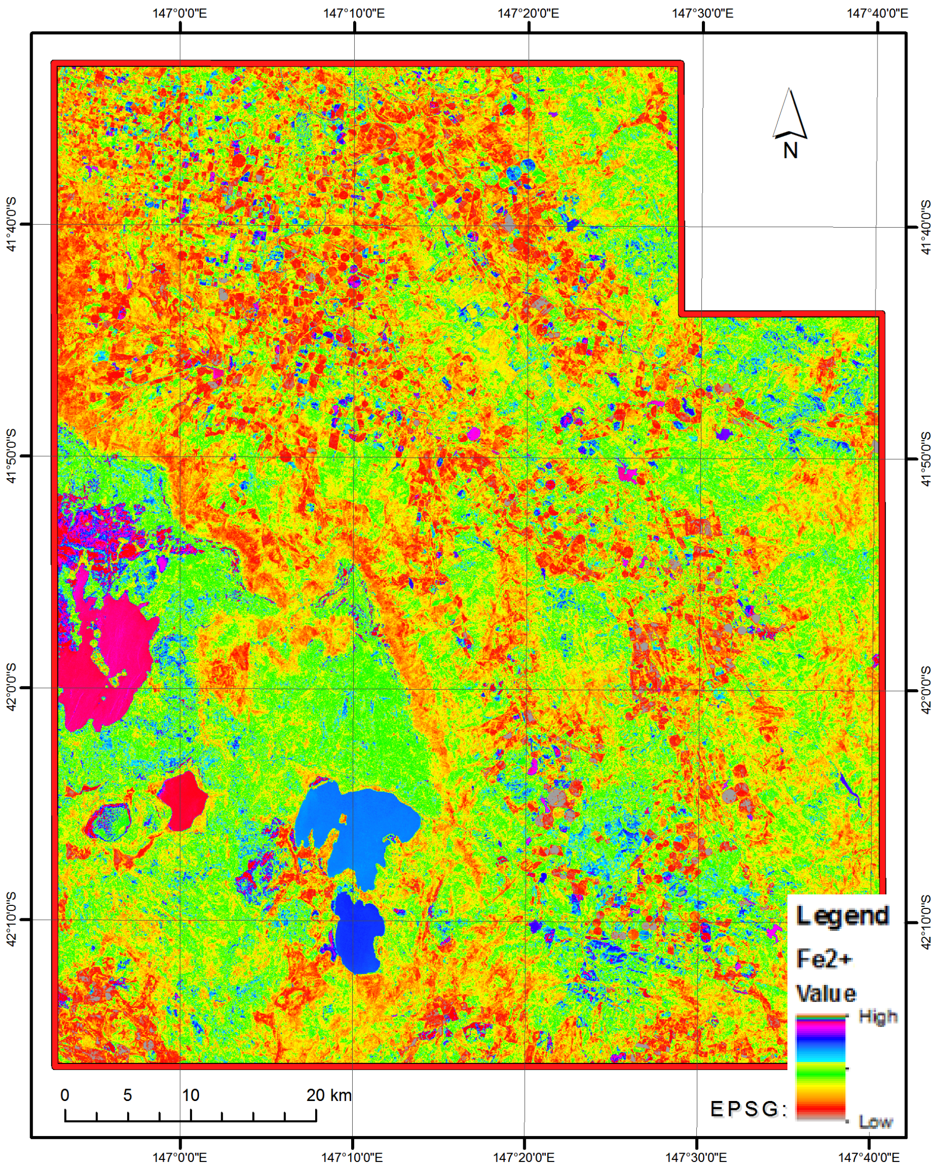


Figure 44: Iron concentration.

Summary of the indexes		
Iron Oxide	**Band 4/band 2**	Hydrothermally altered rocks: Jarosite, goethite, and hematite. Sedimentary rocks : Hornblende and biotite in the sand deposits and alluvium derived.
Clay minerals	**Band 6/band 7**	Phyllosilicates, sulfates, or amphiboles
Ferrouse minerals	**Band 6/band 5**	Propylitic alteration, hema-tite, goethite
Water	**Band 6/band 3**	Water content

3.1.8 MINERAL COMPOSITES

Indexes described above were combined into composites.

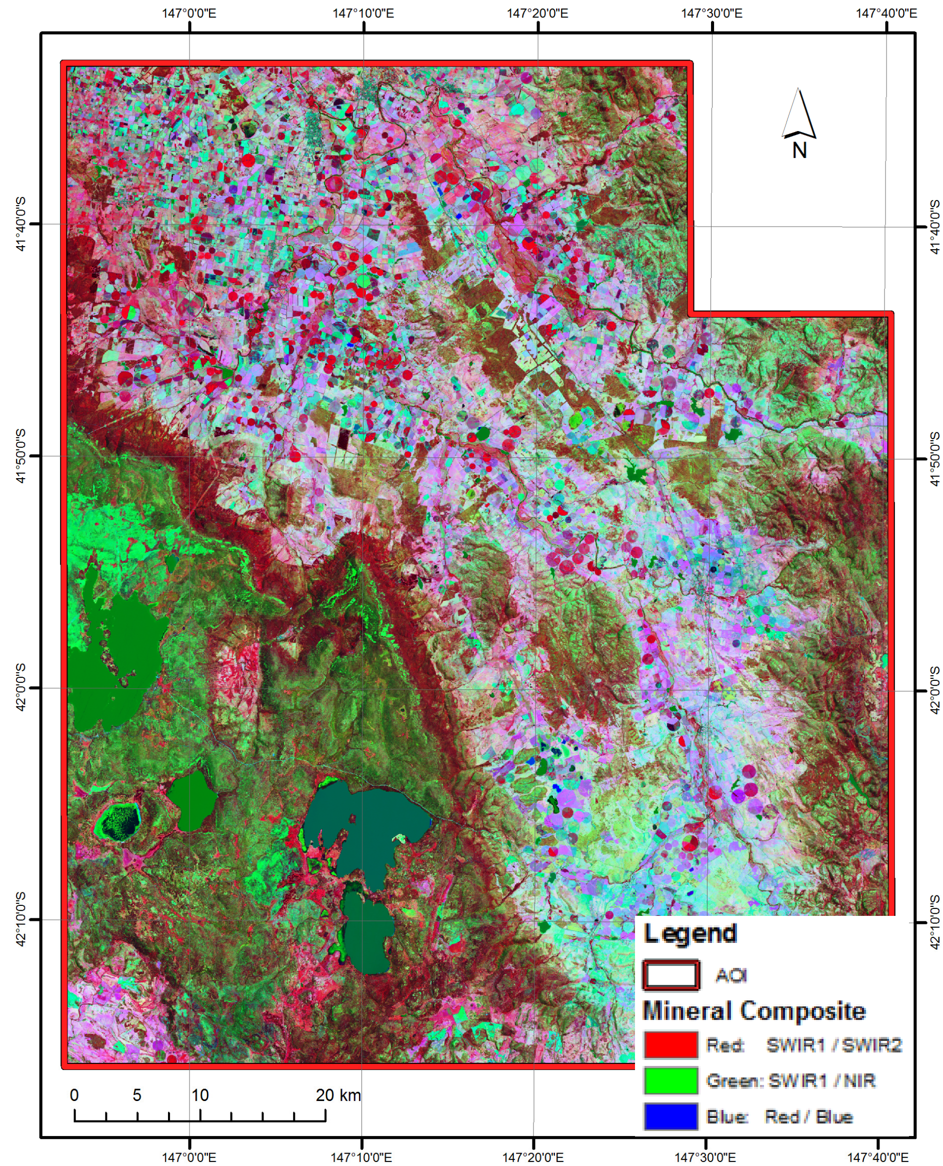


Figure 45: Mineral composite in RGB-view.

Clay minerals - Red, ferrous mineral - Green, iron oxide minerals - Blue.

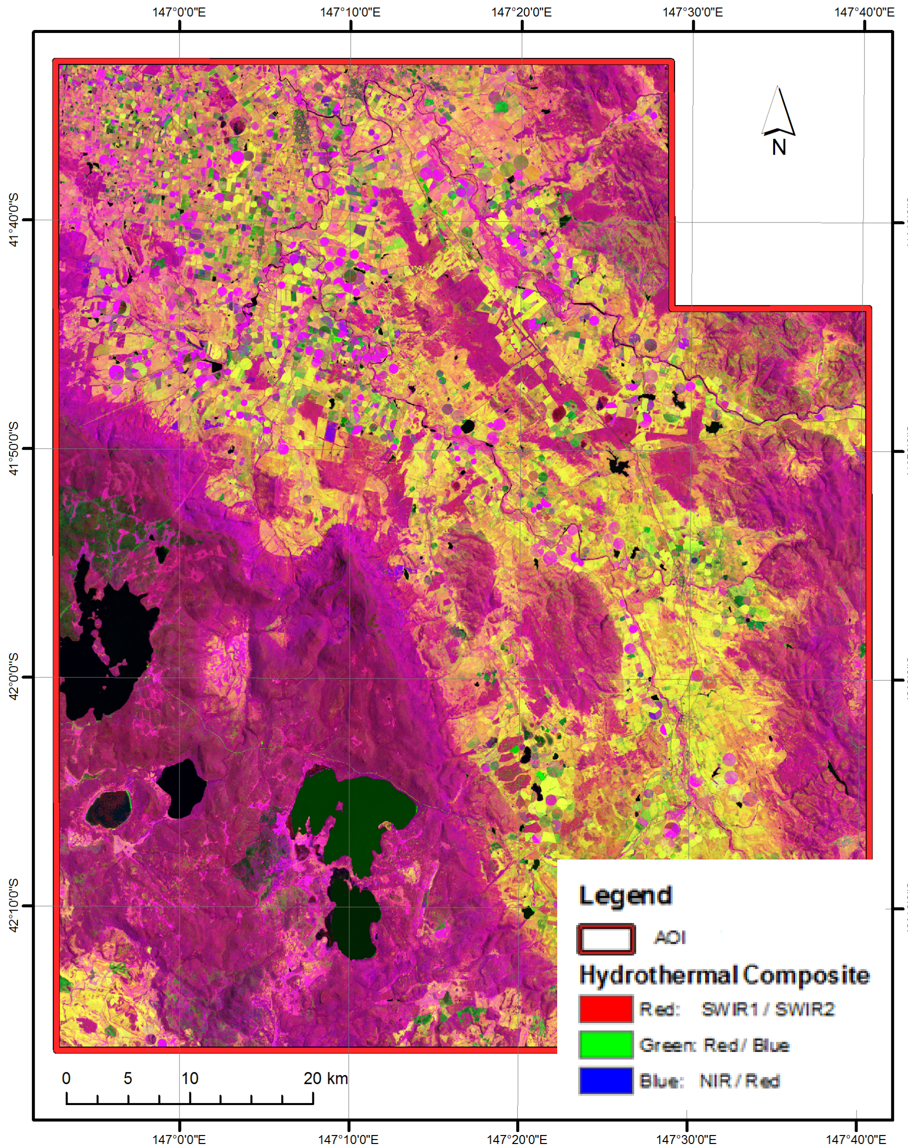


Figure 46: Hydrothermal composite in RGB-view.

Mineral composite is useful for lithological discrimination of the territory. Hydrothermal composite is suitable for expression alteration zones. Altered intrusive rocks are highlighted in yellow and red colors. Felsic volcanic rocks show brown to gray colors together with green. Alluvial rocks show blue, green, and pink to purple depending on the bedrock composition.

3.2 THERMAL STUDY

For brevity reasons, preliminary thermal study images are provided on a USB memory stick.

3.3. PROPRIETARY SPECTROMETRIC PROCESSING – REMOTE "SEISMIC" SCANNING (PSP-RSS)

PSP-RSS is a study of the effects of endogenous seismic fields of the Earth utilizing remote sensing data. The technique is based on the analysis of the pattern of wave interference that formed on the Earth's surface as a result of diffraction of natural seismic waves in geological heterogeneities using satellite imagery.

3.3.1METHODOLOGY BRIEF

PSP-RSS study implemented by Terra reconstructs the subsurface model based on the remote sensing data with a specific tie-in to hydrocarbons.

Using remote sensing data, reconstruction of the subsurface model is carried out by using the recognition techniques of surface anomalies that occur due to natural seismic emissions/waves scattering within heterogeneities of the geological environment. Statistical characteristics of the recorded on the satellite images distribution of the intensity values of reflected light are calculated in order to locate certain anomalies at varying spatial scales. To improve the signal-to-noise ratio, the method uses the principle of focused aperture synthesis, known in radio-physics.

In summary, PSP-RSS separates subsurface objects with varying acoustic density based on their effect on the surface. At this stage, the regional analysis is being performed in order to better understand the geological structure of AOI.

Using the PSP-RSS algorithms, two geomedium cubes have been constructed and are being analyzed and interpreted.

During the next stages of this analysis, certain geological structures that are prospective for the presence of oil and gas will be delineated.

Several of the examples of current work and screenshots are being displayed here as proof of ongoing work. The cubes have been recorded as media files and are being submitted to MRT on a USB memory stick.

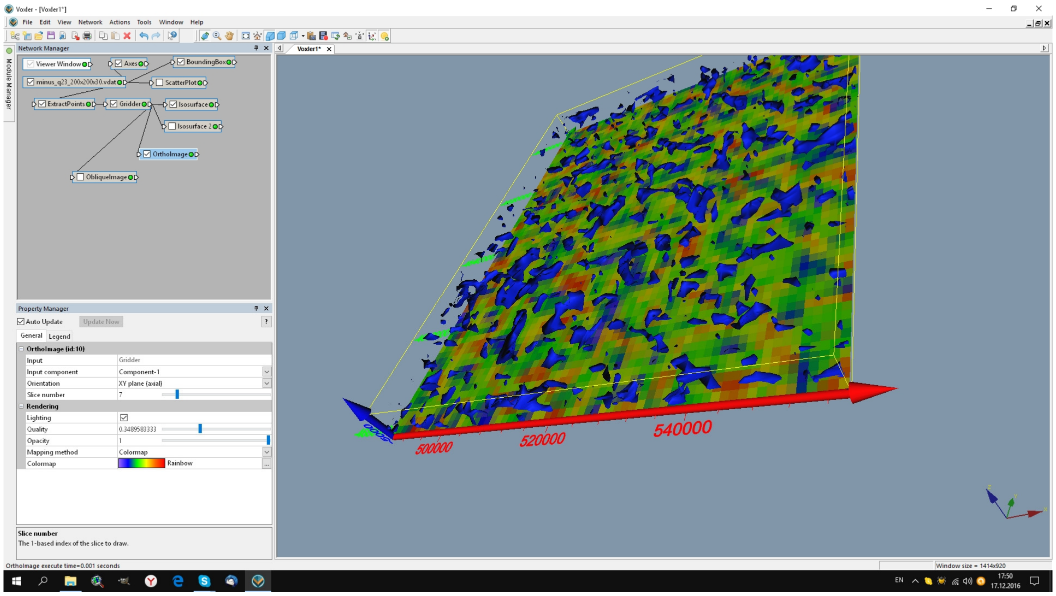


Figure 47: PSP-RSS interim work product – superposition of horizontal section and certain acoustic densities in 3D volume

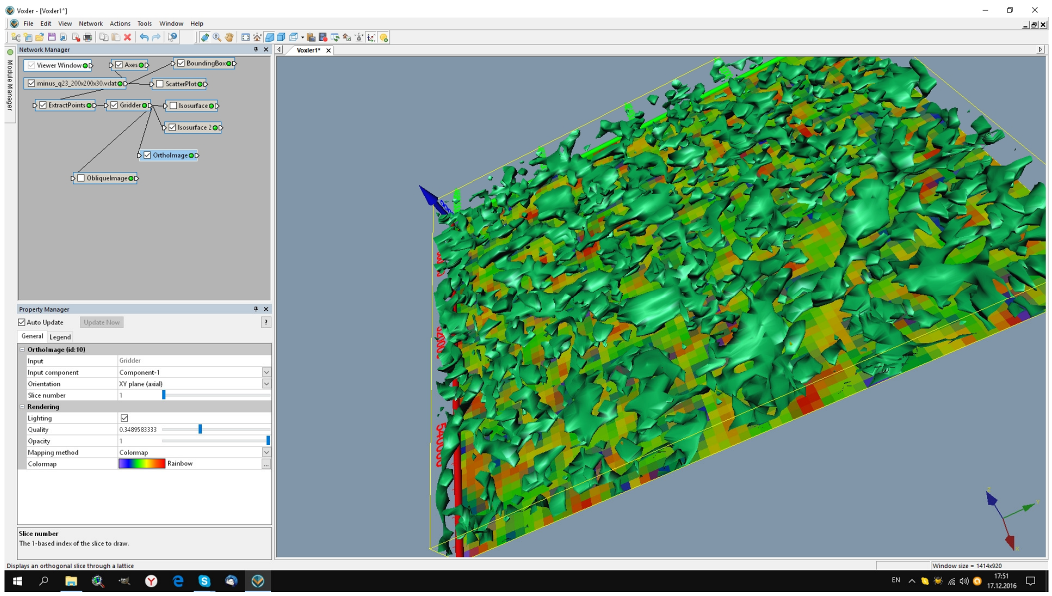


Figure 48: PSP-RSS interim work product – superposition of horizontal section and certain acoustic densities in 3D volume

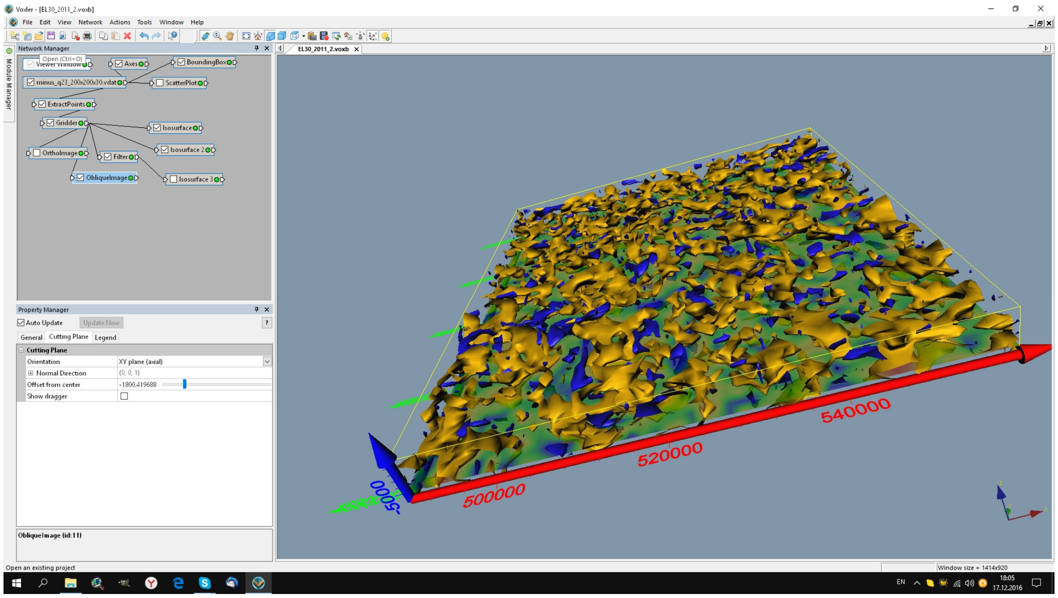


Figure 49: PSP-RSS interim work product – superposition of horizontal section and certain acoustic densities in 3D volume

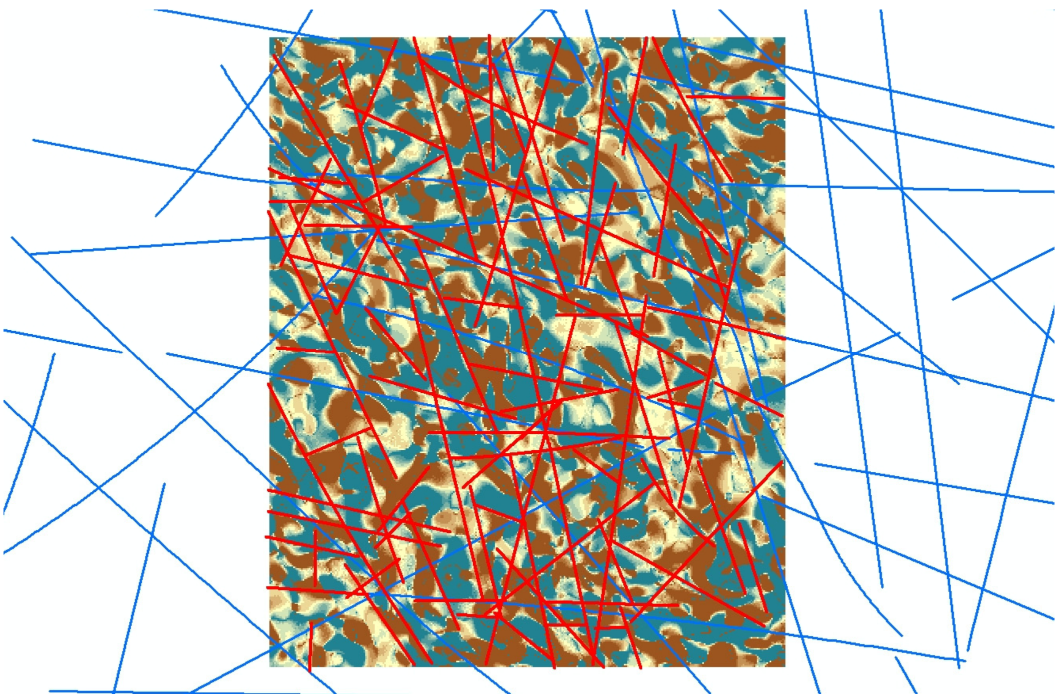


Figure 50: PSP-RSS interim work product – lineament analysis based on PSP-RSS horizontal slices