



Geological Survey of Western Australia



MINERAL SYSTEMS ATLAS

adding value to precompetitive geoscience data



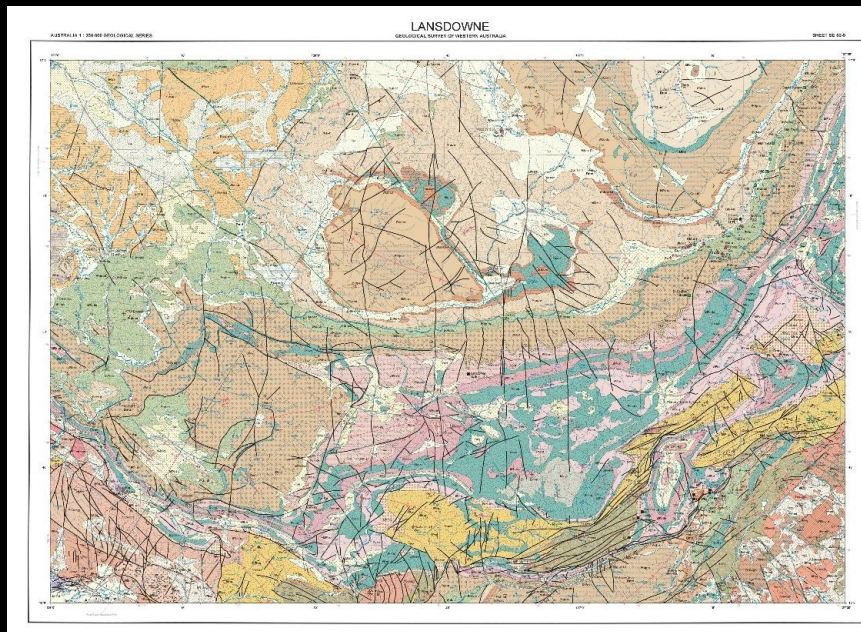
Geological Survey of Western Australia

**130 Years of improving the geological understanding of WA
And supporting mineral exploration**

Geologist in the field



Geological map



GSWA field vehicles





Pre-competitive geoscience information

Geological Survey of Western Australia (GSWA)

Home Geological Survey of Western Australia (GSWA)

Online Systems

Geology and geophysics

GSWA maps the geology of WA to produce robust interpretations of tectonic setting, crustal architecture and geological evolution.

[MORE](#)

Mineral exploration

Find out how GSWA's mineral exploration geoscience section is promoting investment in the resources sector.

[MORE](#)

Oil, gas and geothermal

Access reports, maps and geographic information systems (GIS) on the geological and resource potential of Western Australia's basins.

[MORE](#)

Exploration Incentive Scheme (EIS)

EIS supports exploration in Western Australia through precompetitive data and a co-funding program for innovative exploration drilling.

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Download free PDFs of GSWA maps and publications from the department's eBookshop.

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GeoVIEW.WA

Welcome to DMIRS Data and Software Centre

View, query and map statewide geology, resources information, and related datasets using GeoVIEW.WA, GSWA's online GIS-based mapping tool.

[MORE](#)

Geology mapping app for mobile...

View, query and integrate geological and resource information on a mobile web browser through this free GIS viewer.

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Data and Software Centre

Download free spatial datasets relating to geology, mining and petroleum information, geochemistry and more, as well as spatial application.

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Government of Western Australia
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Metamorphic history of the Mougoodera Formation, Yilgarn Craton, Western Australia

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Thela 1, Canning Basin, Digital Core Atlas

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...and digital data



GSWA
Databases

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Getting Around Identify Tools Drawing & Measurement Maps & Data Sources Search Tools Printing Help & Feedback

What's New? Initial View Full Extent Previous Extent Next Extent Pan Zoom In Zoom Out Identify

Zoom Tools

Legend

- Geoscience Information
 - GSWA Geochemistry
- Geology
 - 1:500 000 Interpreted Bedrock Geology, 2016

I want to...

Copyright © 2018 DMIRS

Lat Long 200km 350

GeoVIEW.WA



What's new Datasets

- Statewide spatial datasets
 - 1:100,000 geological series mosaic images
 - 1:250,000 geological series mosaic images
 - 1:250,000 topographic series mosaic images
 - 3D geology
- Geochemistry
 - GSWA Geochemistry
 - GSWA Geochemistry search online
 - GSWA Archaean mafic and ultramafic volcanics, Eastern Yilgarn craton, Western Australia
 - GSWA Regolith geochemistry
 - Laterite geochemical database for the western Yilgarn Craton
 - Warakurna LIP geochemistry
 - West Arunta geochemistry
 - BHP Billiton stream sediment geochemistry
 - Hallberg geochemistry
 - Pickands-Mather Kimberley geochemistry
 - WMC surface geochemistry
 - WMC Yamarna geochemistry
- Geochronology
- Geology
 - 1:100 000 Interpreted bedrock geology
 - 1:500 000 Interpreted bedrock geology, 2016
 - 1:500 000 Tectonic units, 2017
 - 1:500 000 Orogenic events, 2018
 - 1:500 000 State regolith 500m grid
 - 1:500 000 State regolith 800m grid
 - 1:500 000 State regolith 1300m grid
 - 1:1 000 000 Surface geology of Western Australia
 - 1:2 500 000 Geological map of Western Australia, 2015
 - 1:2 500 000 Depth to Base Phanerozoic
 - 1:10 000 000 Tectonic units, 2016

Data and software centre



How to deliver our data better?

Find data

Download data

Prepare data

Data ready to use

**Time &
resources
consuming**



*Geologists trying to
find the best approach*

We want our users to spend their time and money exploring or understanding our geology



How to deliver our data better?

Streamline the delivery of data

Provide tailored layers

Systematically interrogating our databases

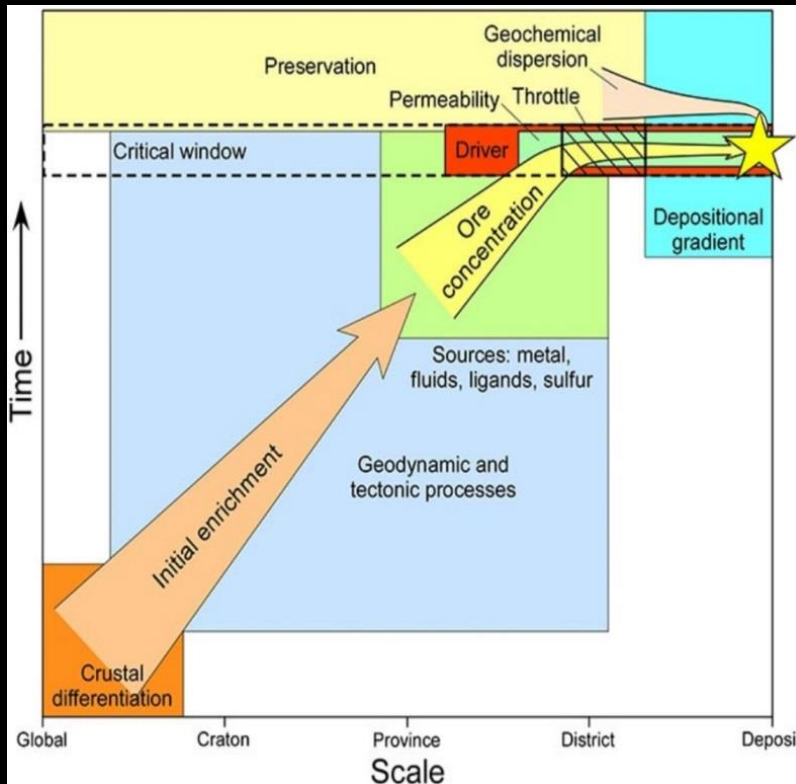


How do we get there?



Mineral system approach

A **Mineral System** is all geological factors that control the **generation and preservation** of a mineral deposit



Critical ingredients:

- SOURCE
- PATHWAY
- TRAP
- PRESERVATION



Chocolate mousse



Critical ingredients

Example for BIF-hosted iron ore
(Iron Formation system)

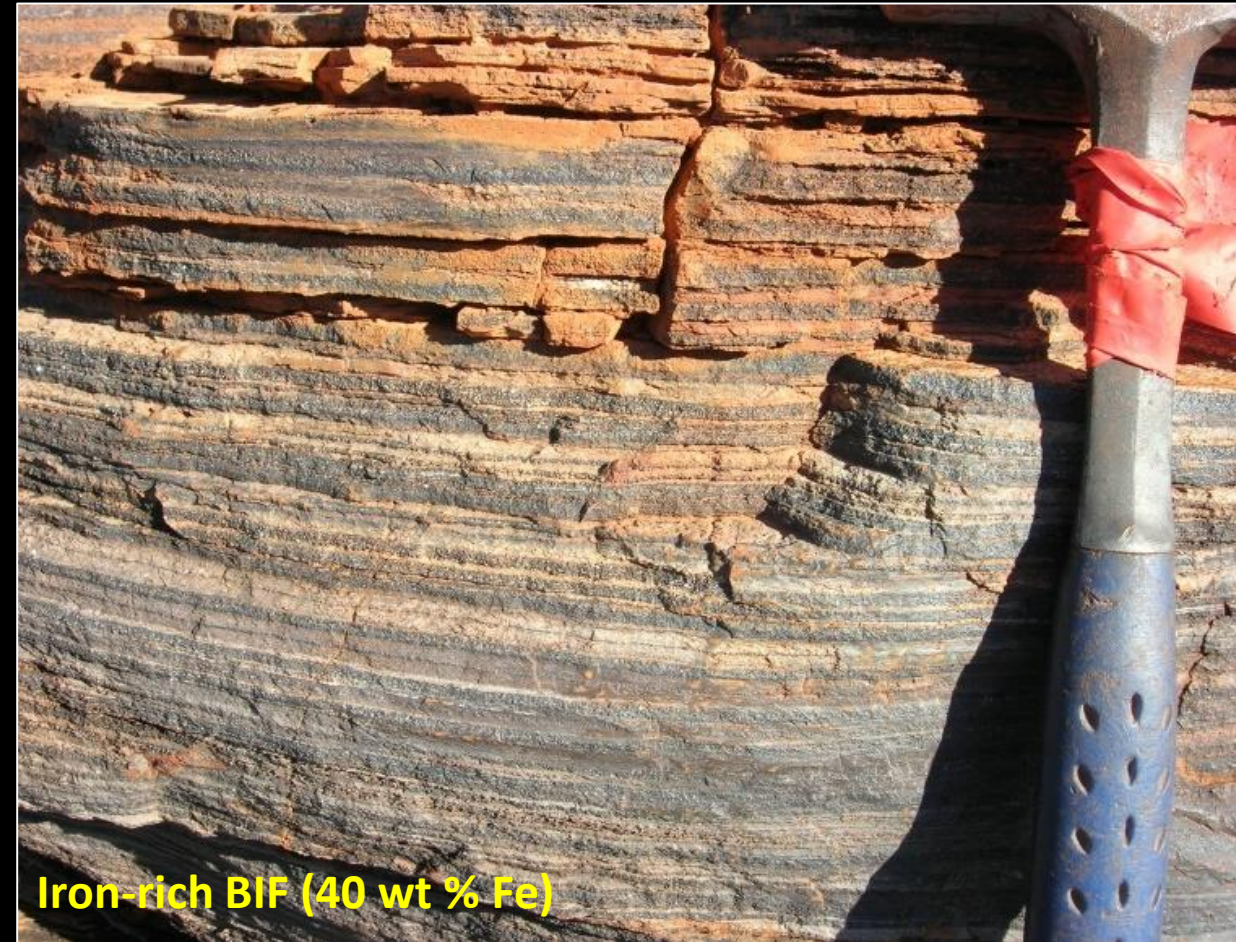
Critical ingredients:

SOURCE: Iron formation + Si-dissolving fluids

PATHWAY : High permeability

TRAP: Alteration of iron formation

PRESERVATION: Protection from erosion



Iron-rich BIF (40 wt % Fe)

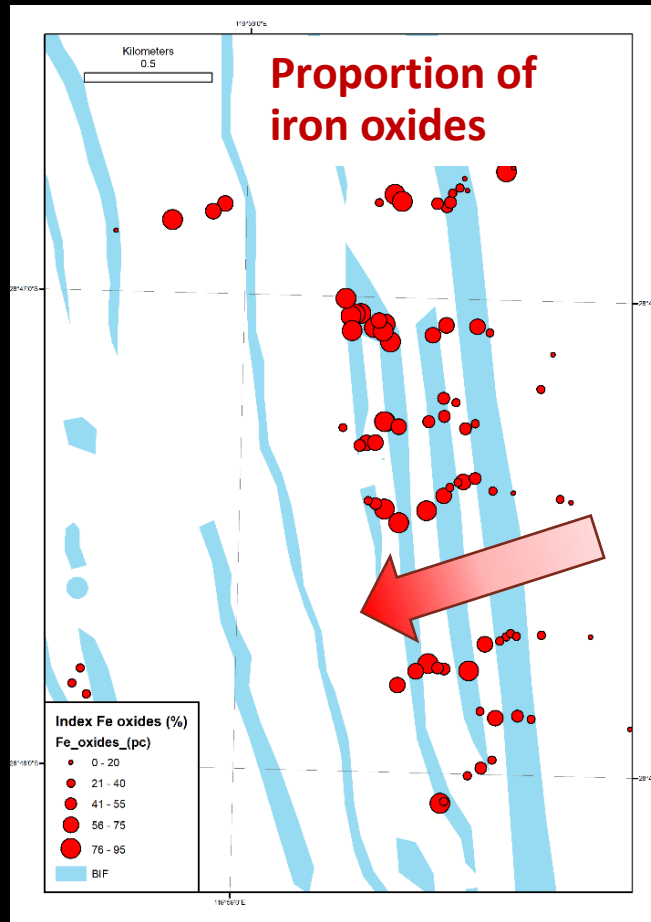
Mt Richardson deposit example



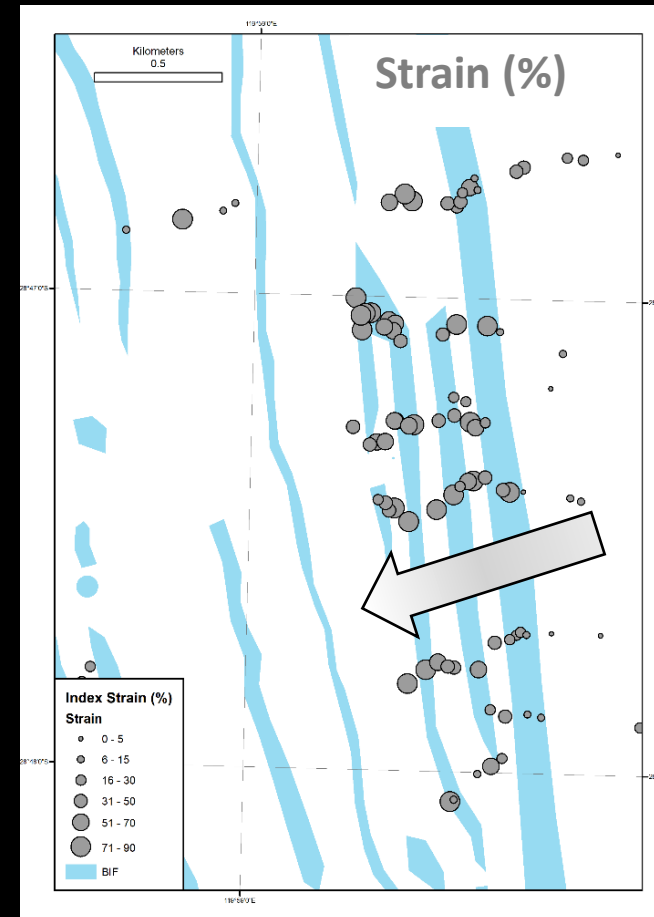
Mappable proxies

Proxies for SOURCE and PATHWAY

Mappable proxies for **SOURCE** (BIF and fluids)



Mappable proxy for **PATHWAY**



Mt Richardson deposit example



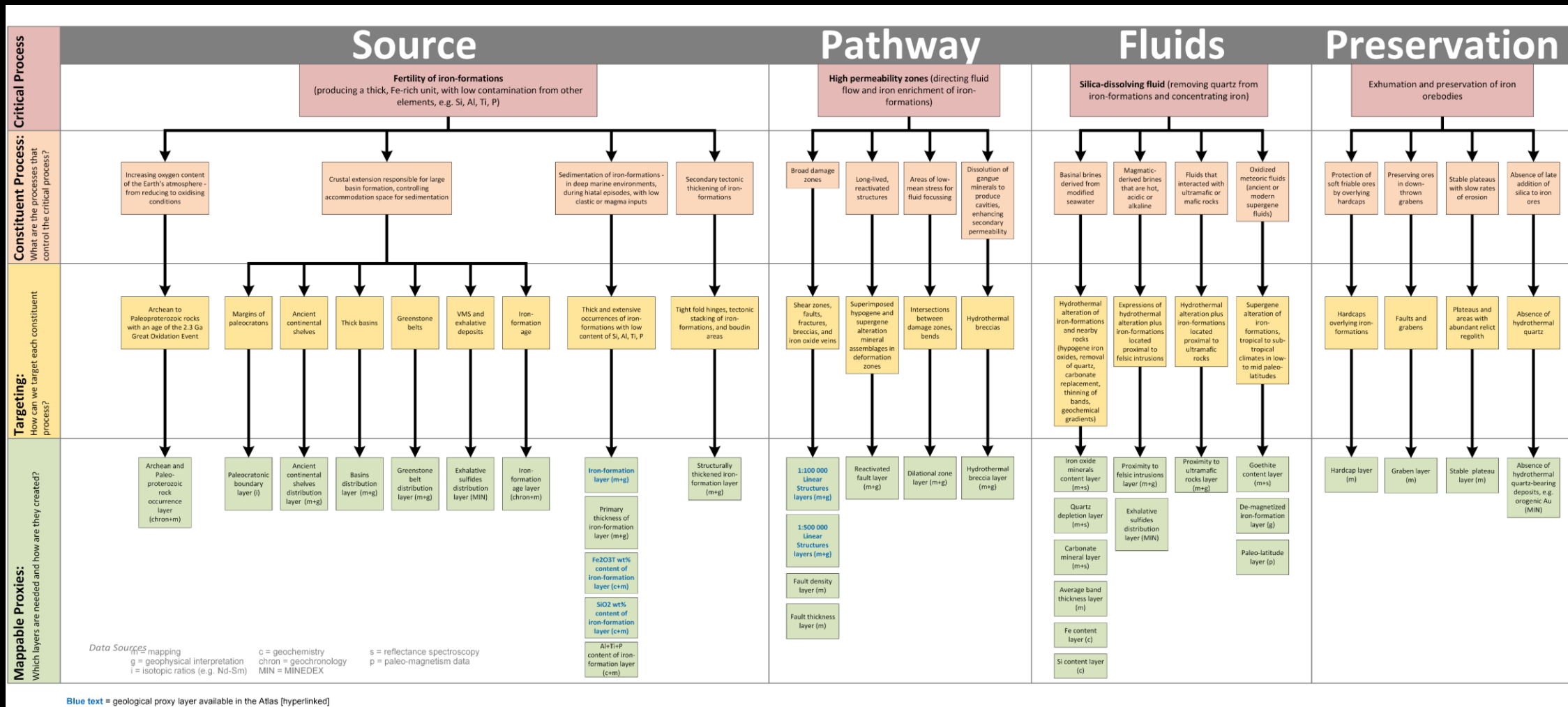
Deciding the layers to create

Critical Process

Constituent Process

Targeting

Mappable Proxies



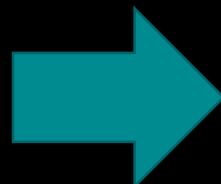
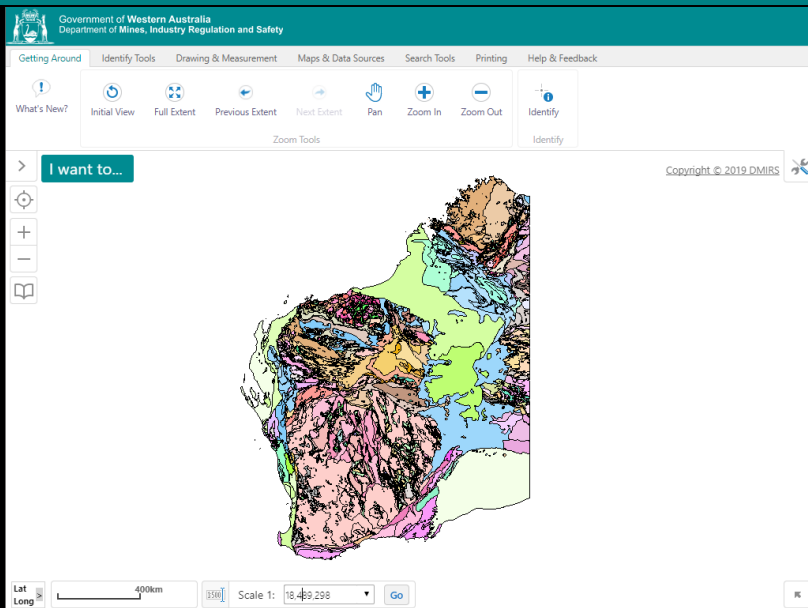
Blue text = geological proxy layer available in the Atlas [hyperlinked]

Mineral System Tree

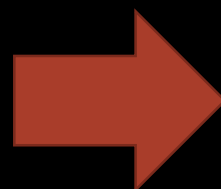
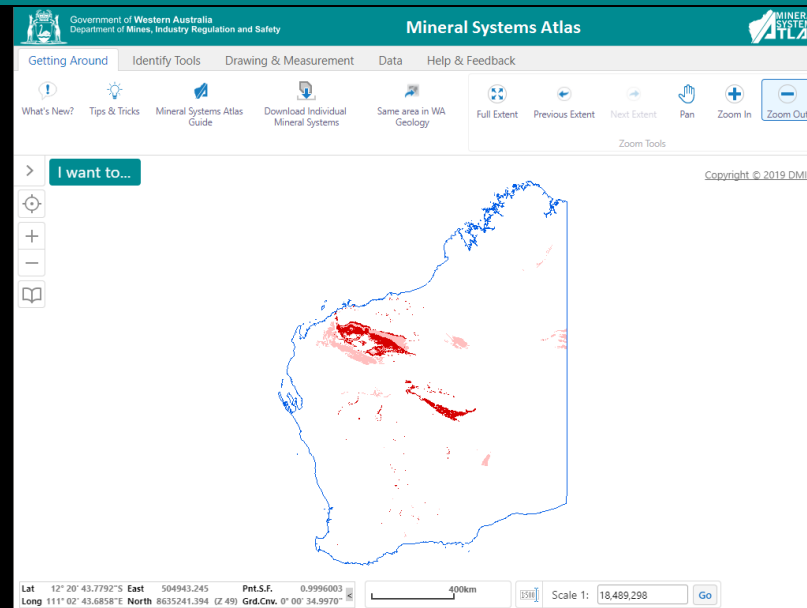


Filtering datasets

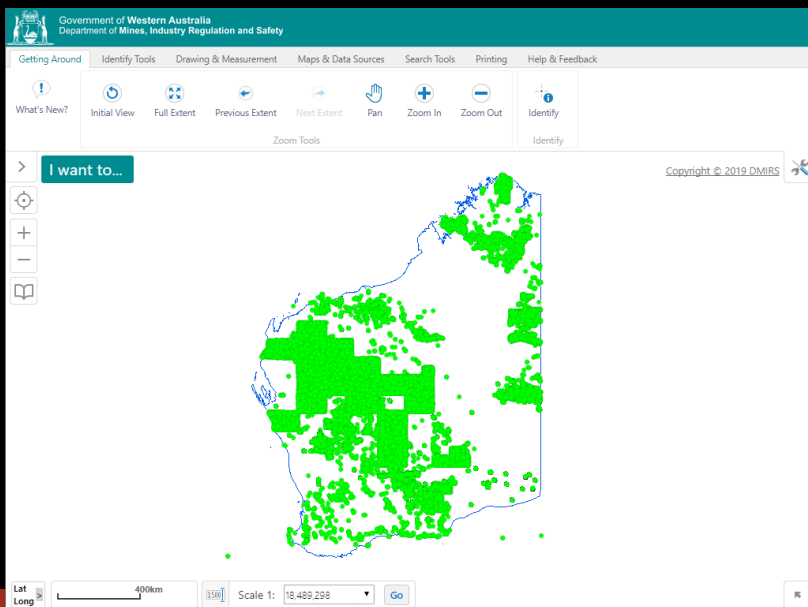
500K Geology



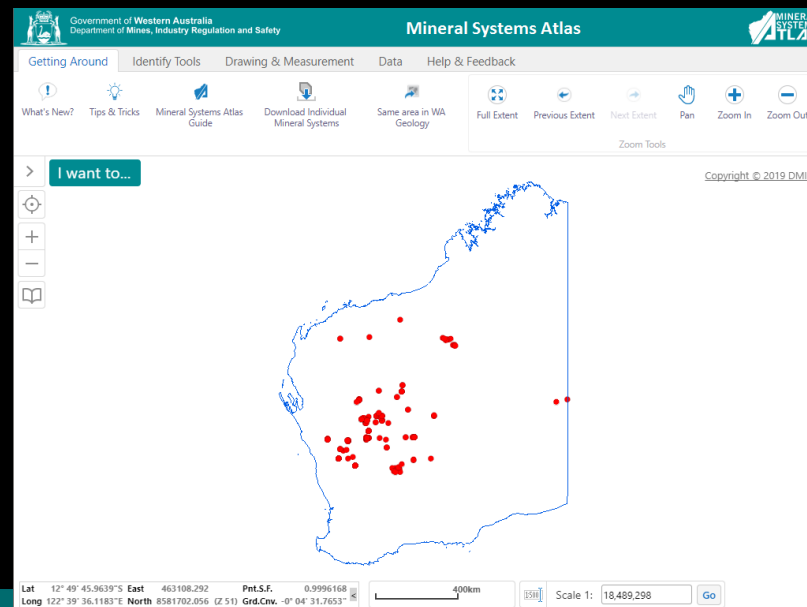
Iron Formation



GSWA Geochemistry

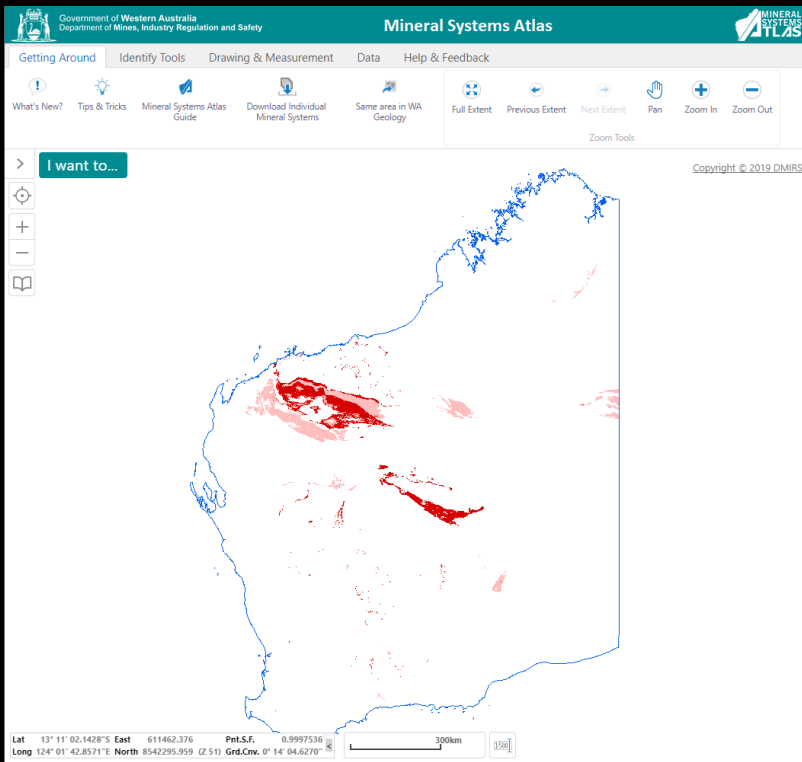


Geochemistry - iron formation

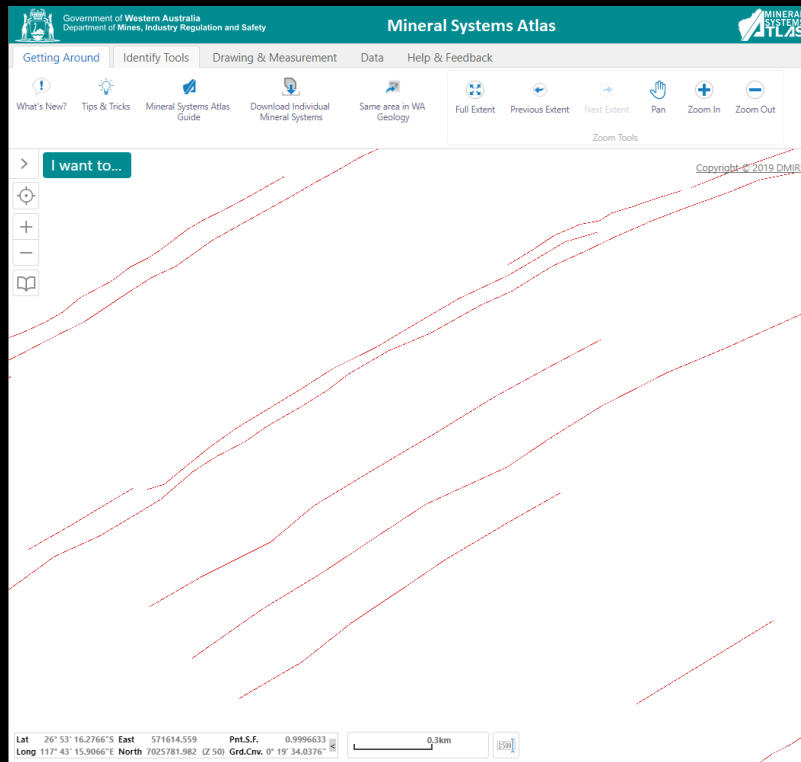




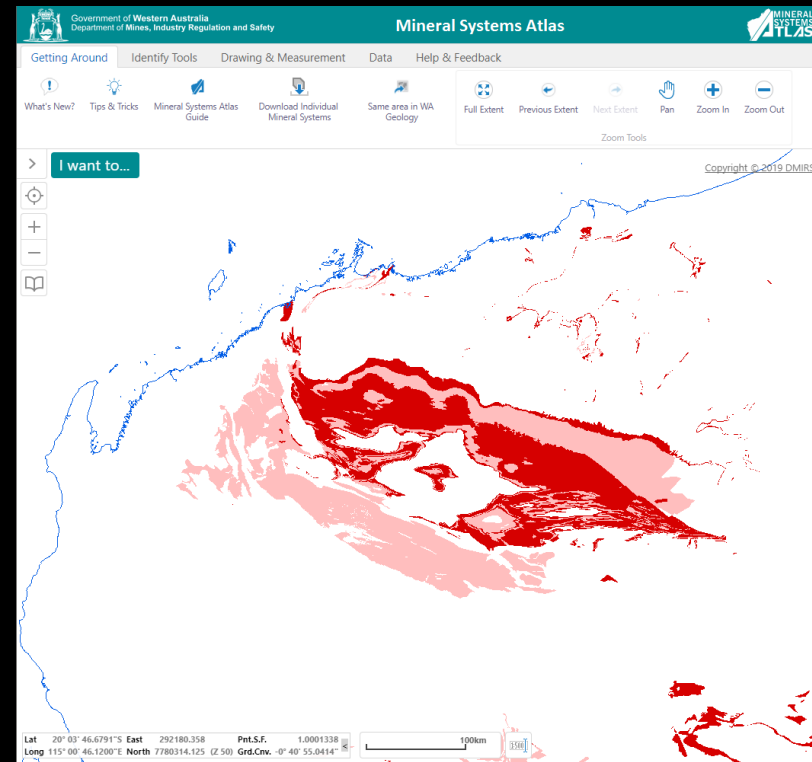
Preparing datasets



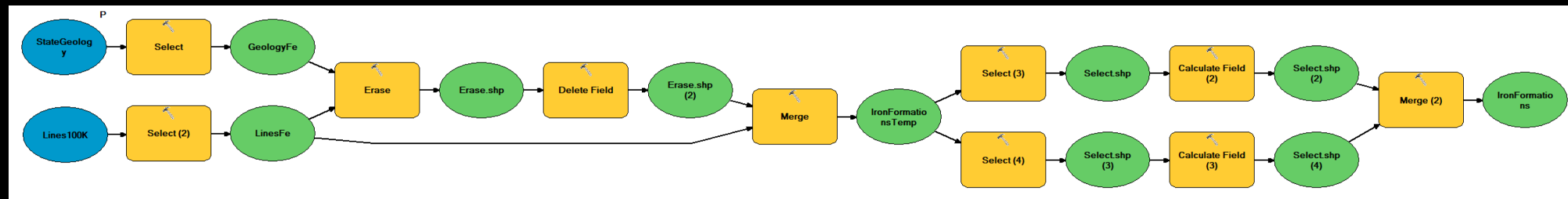
Iron formation



Iron formation line and polygon



500K and 100K iron formation



ArcGIS model for merging these datasets

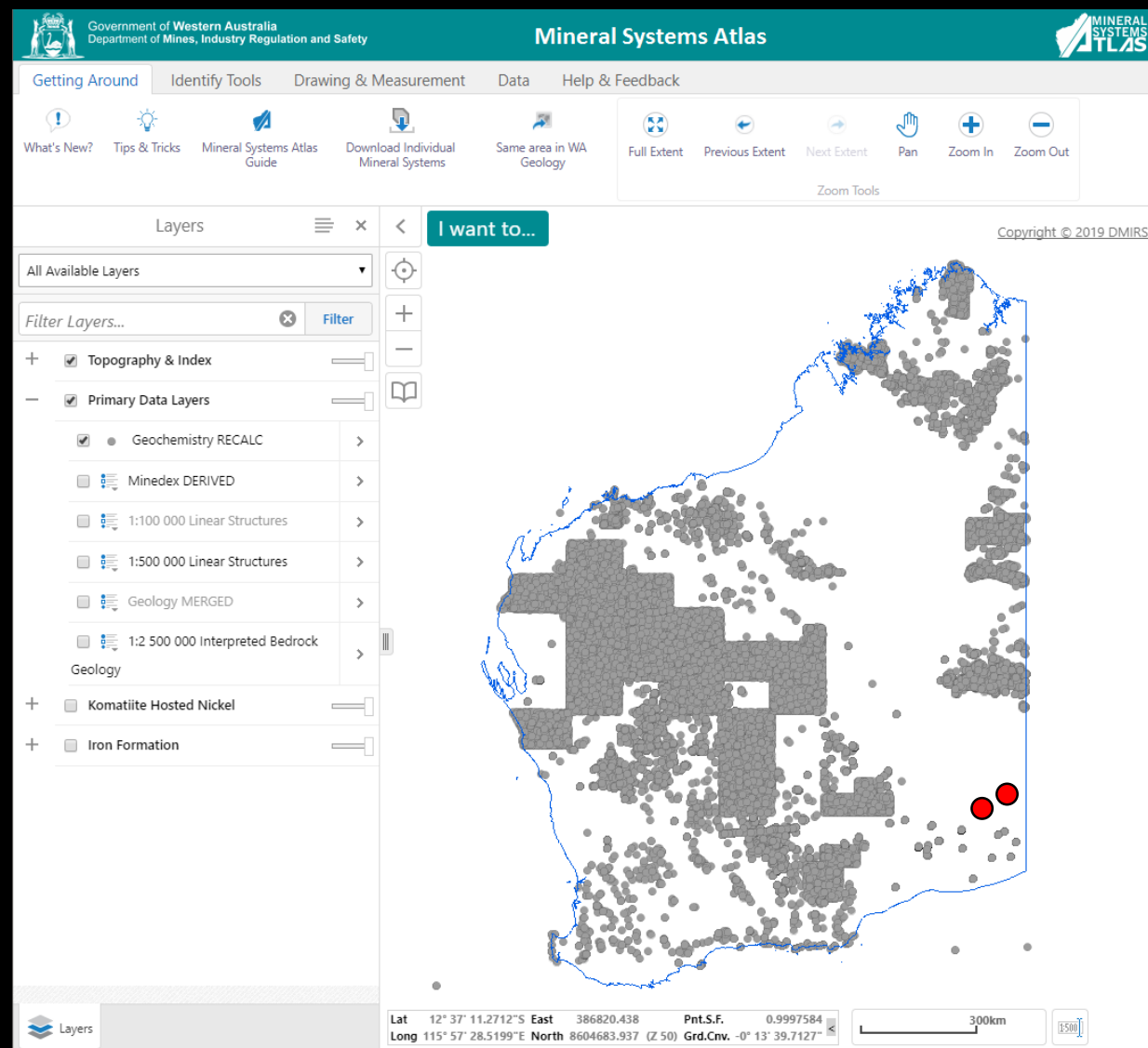


Data are always up to date

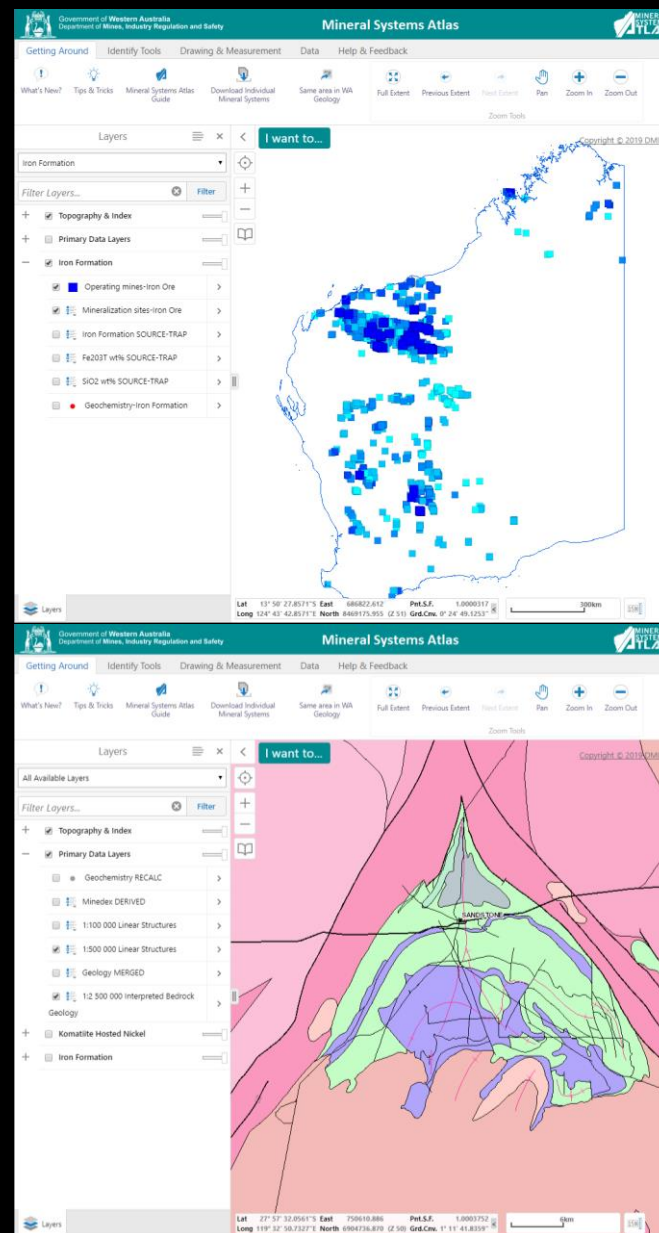
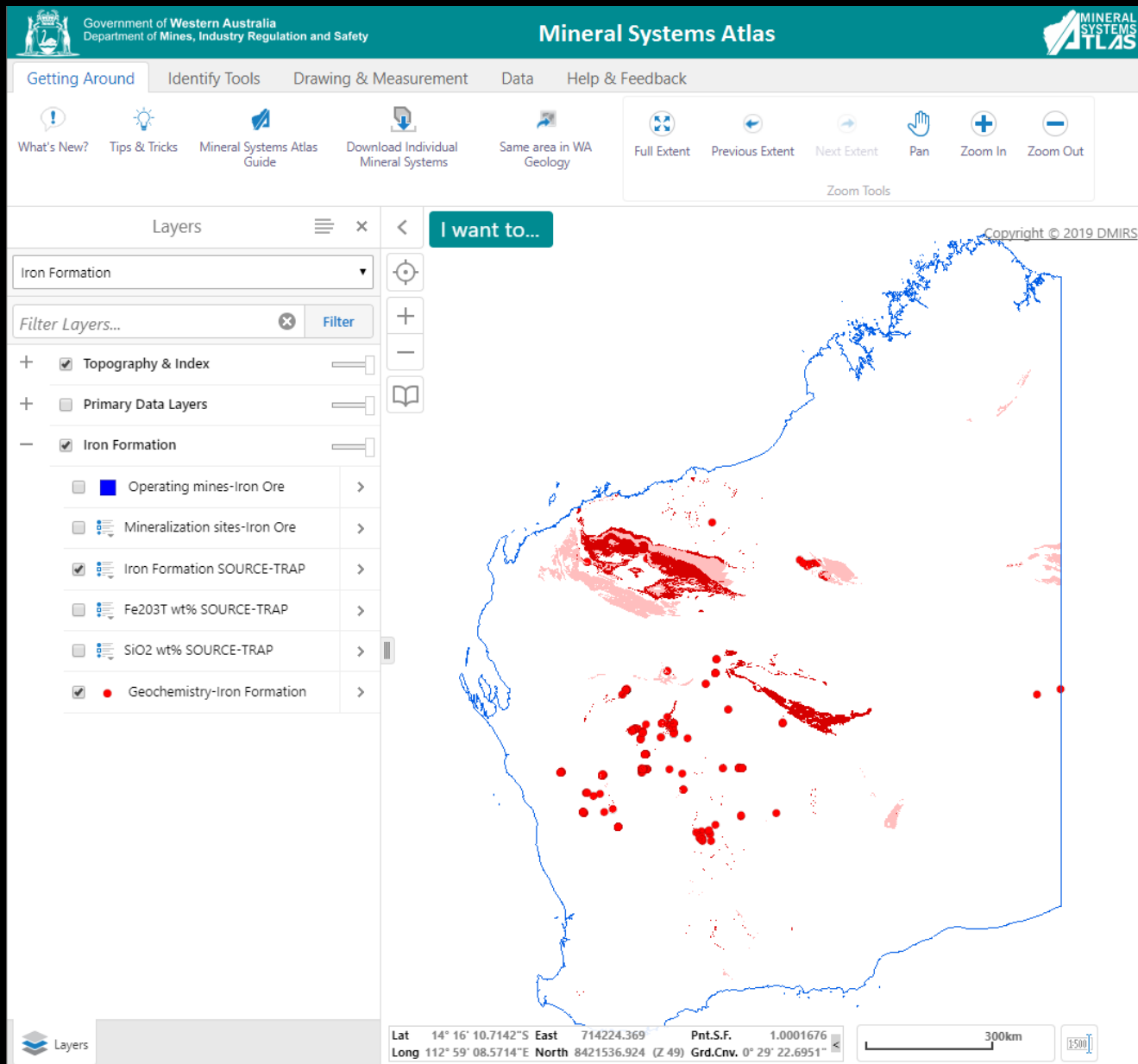
Databases constantly evolve

Users need the latest data

Automation of layer creation



Mineral System Atlas interface



MINEDEX data:

Operating Mines – iron ore

Mineralization sites – iron formation

Primary Data Layers:

Geology + Structure + Topography

Mineral System Atlas Guide

Home

Find Mineral Systems by Process

Find Mineral Systems by Commodity

Mineral Systems

Contact Us

MINERAL SYSTEMS ATLAS

Welcome to the Mineral Systems Atlas Guide

- › What is the Mineral Systems Atlas?
- › Mineral Systems Analysis
- › The Atlas Interface
- › The Atlas Guide
- › What's New?
- › Acknowledgments

[Open Mineral Systems Atlas](#)

What is the Mineral Systems Atlas?

The **Mineral Systems Atlas** is an interactive GIS-based platform that collates and delivers map-based geoscience data layers filtered to be specifically relevant to understanding and exploring for mineral deposits in Western Australia. **Atlas** content is systematically defined by applying the mineral systems concept advocated by [Wyborn et al \(1994\)](#) and [McCuatig et al. \(2010\)](#). The premise of this concept is that mineral deposits will only form and remain preserved where there has been a spatial and temporal coincidence of critical earth processes (geodynamic setting; lithosphere architecture; fluid, ligand and ore component reservoir(s); fluid flow drivers and pathways; depositional mechanisms; post-depositional processes), and that the occurrence of these critical processes might be recognized from mappable geological features expected to result from them. It is these geological features ("targeting elements" or "geological proxies") that can potentially be extracted as digital map layers from geoscience datasets, and that may be subsequently used in GIS-based prospectivity studies.

The **Mineral Systems Atlas** is by its very nature a continuous work in progress. The modular and hierarchical design of its online platform and user guide will readily permit the addition of new mineral systems and new geological proxy layers as these progressively become available. Users are encouraged to learn about the latest releases of data layers, and other additions to the **Atlas**, by viewing the [What's New?](#) present in the interface and the [Guide](#).

Mineral Systems Analysis

Different mineral systems (as defined by [Fraser et al., 2007](#)) are analysed to define the mappable geological proxies for critical mineralizing processes. Such analyses draw on in-house knowledge, existing literature, and collaborations with subject-matter experts. Structured queries are then used to extract relevant data from one or more state-wide GSWA geoscience databases, for those proxies that can be practicably produced. These queries operate directly on, and are dynamically linked to, primary GSWA geoscience data sources. No new data are acquired or created, although some information may be reformatted to meet the internal requirements of particular map layers. Furthermore, the queries are scheduled to automatically update the derived proxy map layers whenever new data are added to the primary databases. Users may therefore be confident that the data layers portrayed in the **Mineral Systems Atlas** are always current.

The Atlas Interface

Mappable proxies are delivered at a statewide scale via the online **Atlas** interface, which is deliberately designed using the HTML5-based version of GeoCortex® to emulate the functional look and feel of GSWA's GeoVIEW.WA and WA Geology viewers. The **Atlas** categorizes map layers by groups of geodynamically related mineral systems (based on [Fraser et al., 2007](#)), or alternatively by commodity groups (as defined in GSWA's MINEDEX database), and allows users to view, select and download only those data sets they require. Downloadable data layers are formatted for compatibility with ArcGIS, MapInfo and QGIS.

Advanced functionality

Landing page of the Guide

Layer page: Operating Mines – iron formation

What is this layer?

All recorded mines, deposits, prospects, and occurrences in Western Australia that contain iron ore as a target commodity.

Legend

Legend	Description
Mine	A working from which mineral production has taken place
Deposit	A mineral occurrence with probable economic value and for which there is an established resource figure
Prospect	Any mineral occurrence where economic grades have been intersected over a significant width and strike length but for which there is not yet a resource, or any working or exploration activity that has found sub-economic mineral occurrences and from which there is no recorded production
Occurrence	An occurrence (excluding those defined as Mines, Deposits, or Prospects) can be defined if an economic mineral has been identified in outcrop, or if assay results exceed an agreed concentration and size. For iron-ore, the agreed concentration is >5m at >50% Fe for brown fields; and >5m at >40%Fe for Greenfields.

Derived from

Minedex-DERIVED

Filtered with

Mineralization sites-Iron Ore

Terms	Query
Iron	TARGET_COMMODITY_GROUP = 'IRON ORE'



Download data

- **Users will be able to download:**

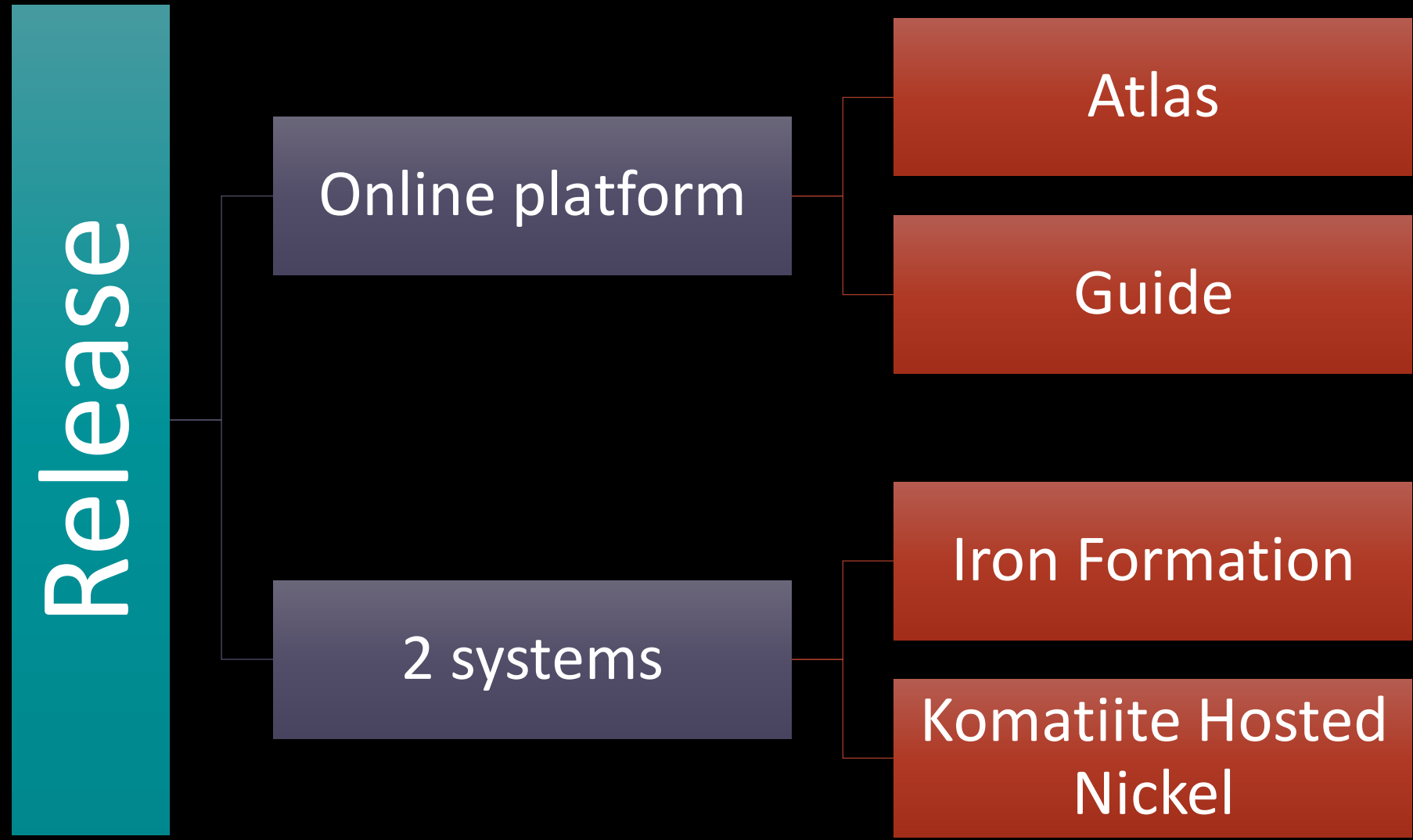
- Primary data layers
- Mineral systems layers

The data are available in various file formats

▲	Mineral System Atlas																
▲	Primary Data Layers																
	<table><thead><tr><th>Last Updated</th><th>Size</th><th>File Format</th><th></th></tr></thead><tbody><tr><td>05/02/2019</td><td>10.98 MB</td><td>ESRI File Geodatabase</td><td>Download</td></tr><tr><td>05/02/2019</td><td>39.77 MB</td><td>ESRI Shape File</td><td>Download</td></tr><tr><td>05/02/2019</td><td>87.29 MB</td><td>MapInfo TAB</td><td>Download</td></tr></tbody></table>	Last Updated	Size	File Format		05/02/2019	10.98 MB	ESRI File Geodatabase	Download	05/02/2019	39.77 MB	ESRI Shape File	Download	05/02/2019	87.29 MB	MapInfo TAB	Download
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05/02/2019	12.00 MB	ESRI Shape File	Download														
05/02/2019	8.58 MB	MapInfo TAB	Download														
05/02/2019	611 KB	ESRI File Geodatabase	Download														
▲	Iron Formation																
	<table><thead><tr><th>Last Updated</th><th>Size</th><th>File Format</th><th></th></tr></thead><tbody><tr><td>05/02/2019</td><td>242 KB</td><td>ESRI File Geodatabase</td><td>Download</td></tr><tr><td>05/02/2019</td><td>5.38 MB</td><td>ESRI Shape File</td><td>Download</td></tr><tr><td>05/02/2019</td><td>3.65 MB</td><td>MapInfo TAB</td><td>Download</td></tr></tbody></table>	Last Updated	Size	File Format		05/02/2019	242 KB	ESRI File Geodatabase	Download	05/02/2019	5.38 MB	ESRI Shape File	Download	05/02/2019	3.65 MB	MapInfo TAB	Download
Last Updated	Size	File Format															
05/02/2019	242 KB	ESRI File Geodatabase	Download														
05/02/2019	5.38 MB	ESRI Shape File	Download														
05/02/2019	3.65 MB	MapInfo TAB	Download														



The Mineral Systems Atlas – today...





The Mineral Systems Atlas – tomorrow...

Add more **Systems**

- Battery metals
- Gold

Interrogate more **Databases**

- Geochronology
- Field observation data (WAROX)



Conclusion

- Always up to date – no need for USB packages
- Saves time and resources
- Less searching and less cleaning of data

- Aimed at explorers, researchers, students...
- Guide can be an educational tool

- A driver for collecting new data
- A tool to inform future GSWA projects
- Influencing database refinements



Geological Survey of Western Australia

We invite you to come to our demonstrations at

Lunch time @13.15 – Live Demo

Afternoon break – Tips and Tricks

