

SA Geology: Laying the groundwork for an integrated approach to geological mapping

SA Discovery Mapping

Jonathan Irvine | 27 November 2025



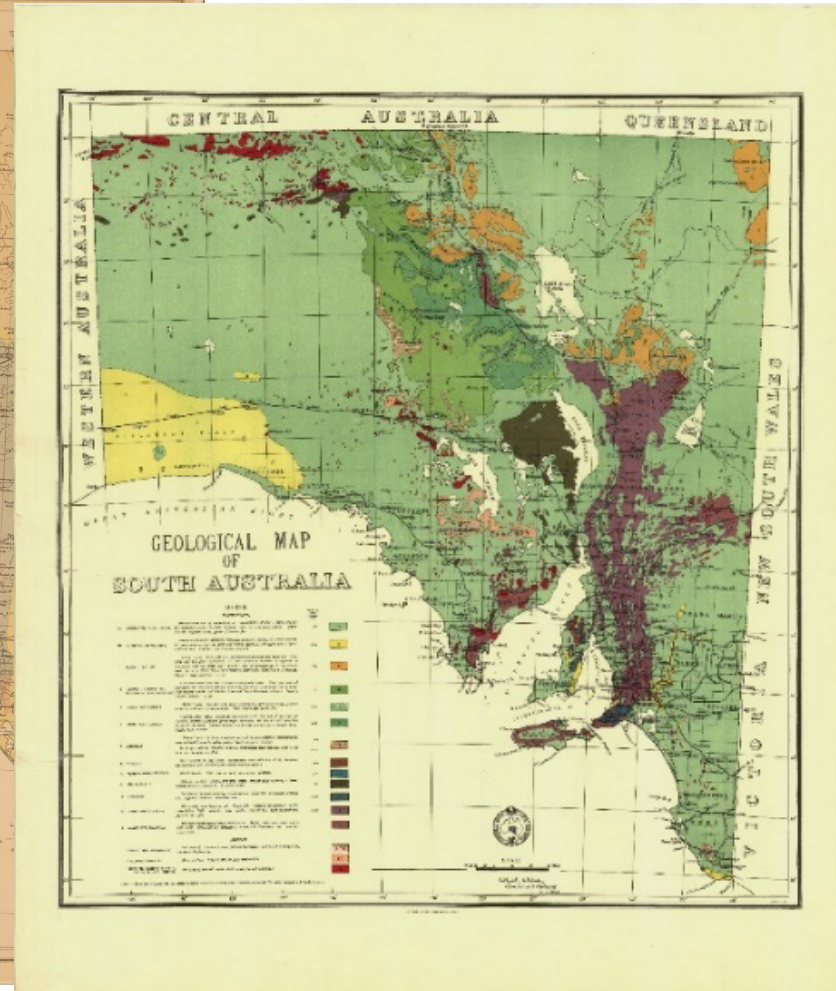
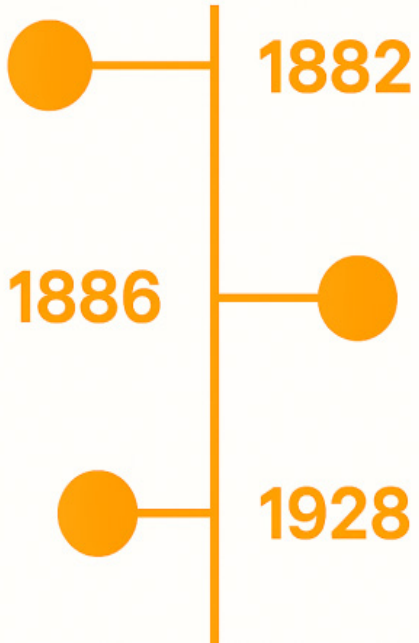
**GEOLOGICAL
SURVEY OF**
South Australia

DISCOVERY DAY



We have always done it this way...

The Geological Survey of South Australia (GSSA) is responsible for the compilation and publication of geological maps for the whole of the State. Products include regional surface geological maps at various scales, solid geology interpretive maps, thematic maps, remote sensed spectral maps and mineral occurrence maps.



GSSA
DISCOVERY DAY



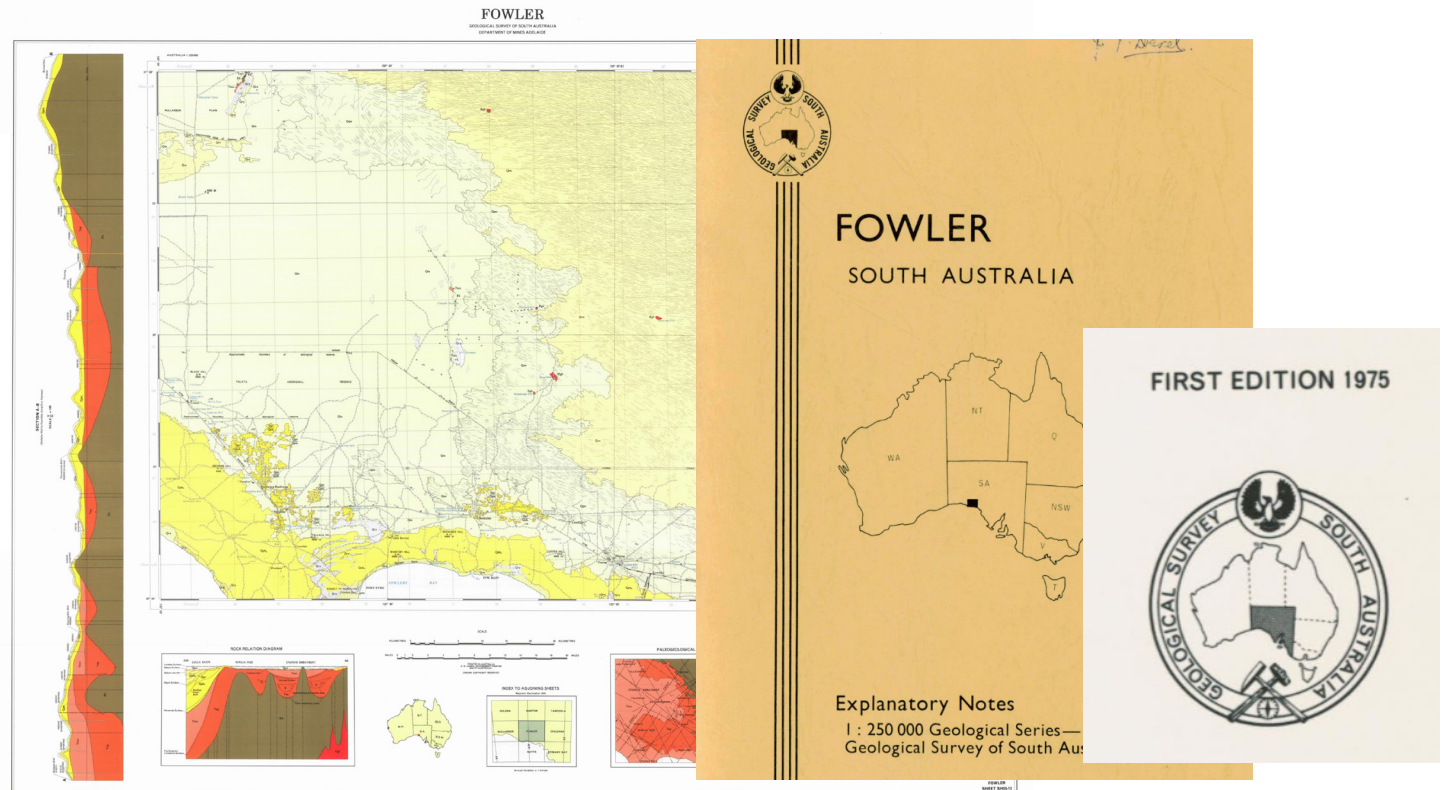
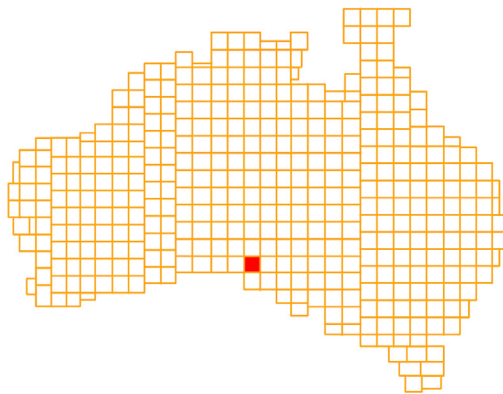
Formalised 250k mapping and a reinvigorated survey

The 1:250 000 geological map series was produced and published by the GSSA between 1954 and 2015.

- These maps were produced in two distinct series, the first using traditional lithographic printing, and the second series using Geographic Information Systems (GIS) techniques.
- ~73 maps were published in this series and some have two editions.
- Released as the “Seamless” 100k Geology - surface geology.

1943

1975



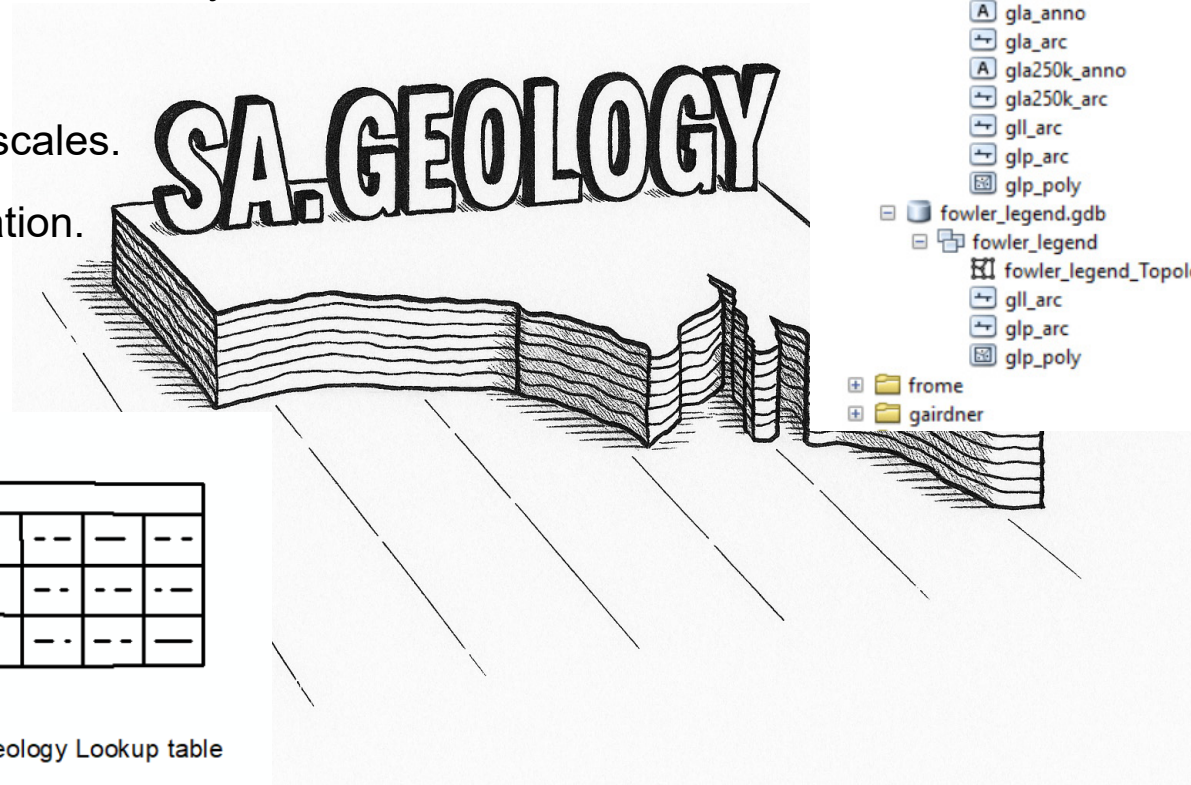
GSSA
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Didn't we already modernise back in the 80's?

1989

In 1989, SA GEOLOGY was to become a computerised geological map database system for the capture, storage, manipulation, viewing and plotting of statewide geological map data.

- Developed by the then Regional Geology and Drafting Branches.
- Basis for geological map production into the 21st Century.
- Developed and maintained on Esri software.
- Map data layers suitable for several display scales.
- Flexible output options and facilitates publication.
- Geological map requirements 1990 – 2010.



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Geological linework & attribute table

Geology Lookup table

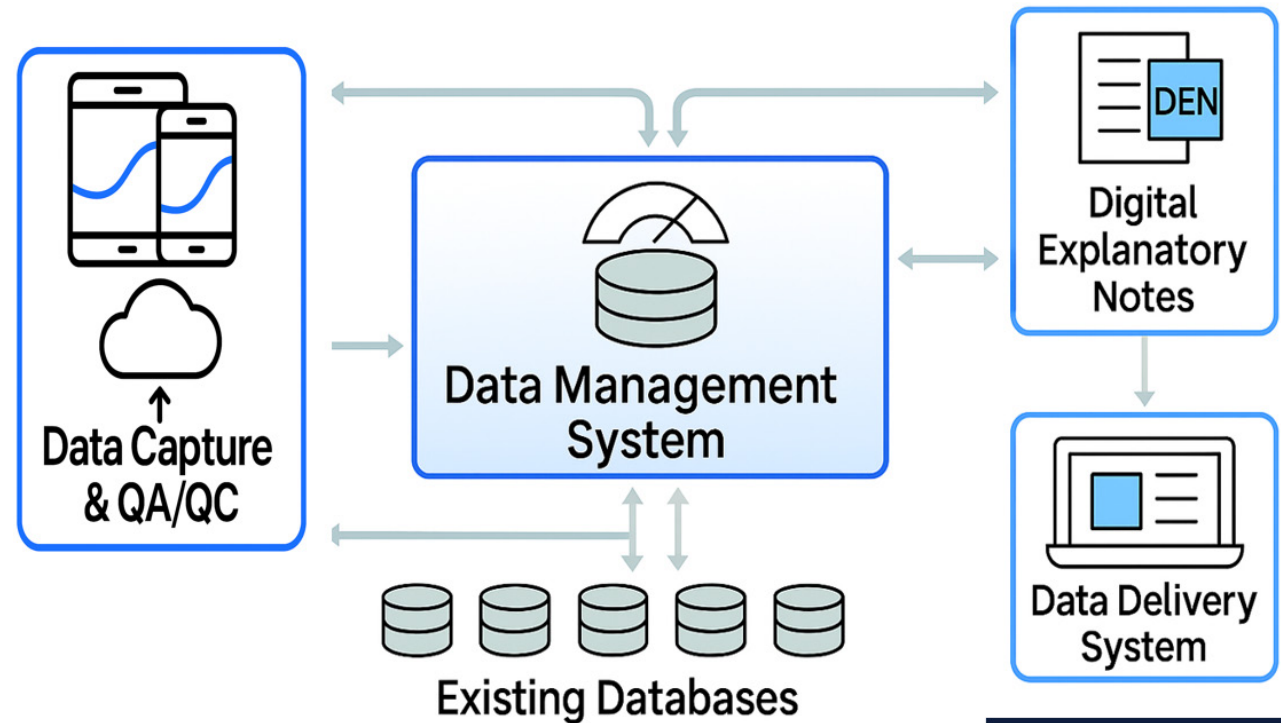
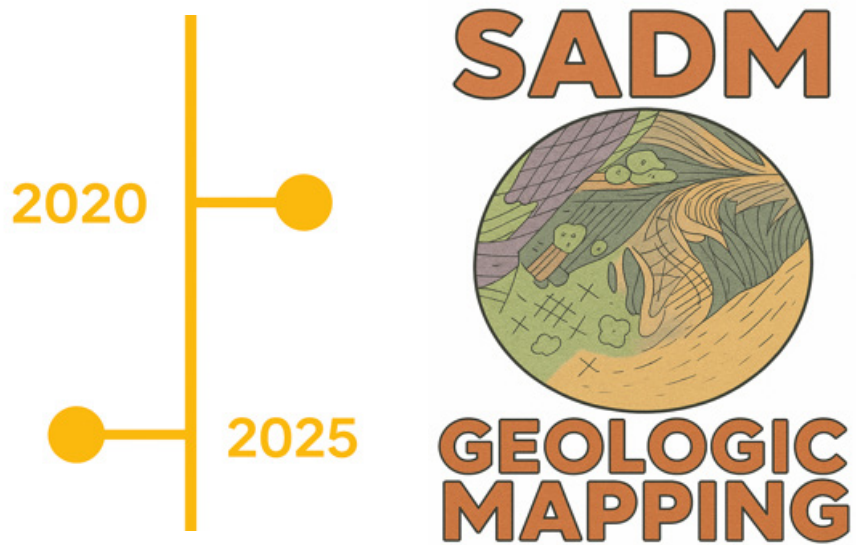


GSSA
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The opportunity: South Australian Discovery Mapping project

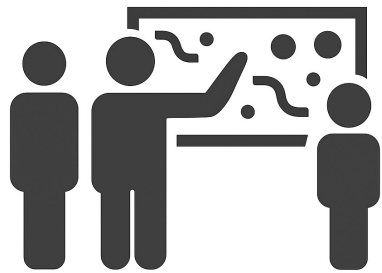
The South Australian Discovery Mapping (SADM) project aimed to modernise the capture, management, delivery and scope of the state's precompetitive geological map datasets, creating a modern, world-class geoscience data asset and platform.



Modern data management system solution

Goal: Create a scalable, interoperable architecture that supports current and future data needs.

- Use a **modular architecture** with APIs for integration.
- Implement **cloud-based storage** with hybrid options for legacy systems.
- Ensure **data standards compliance** (e.g., GeoSciML, OGC standards).
- Include **metadata management** for discoverability and provenance tracking.



Consultation Report



Data Management System

Feature Layer



Geological linework

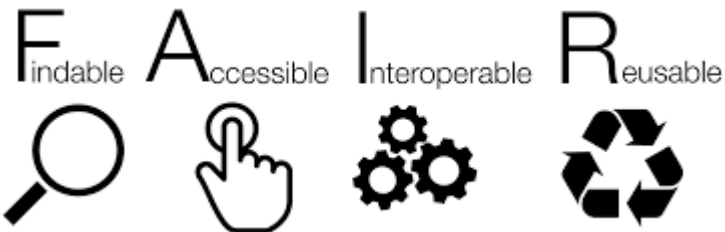
Related



Table



Linear feature table

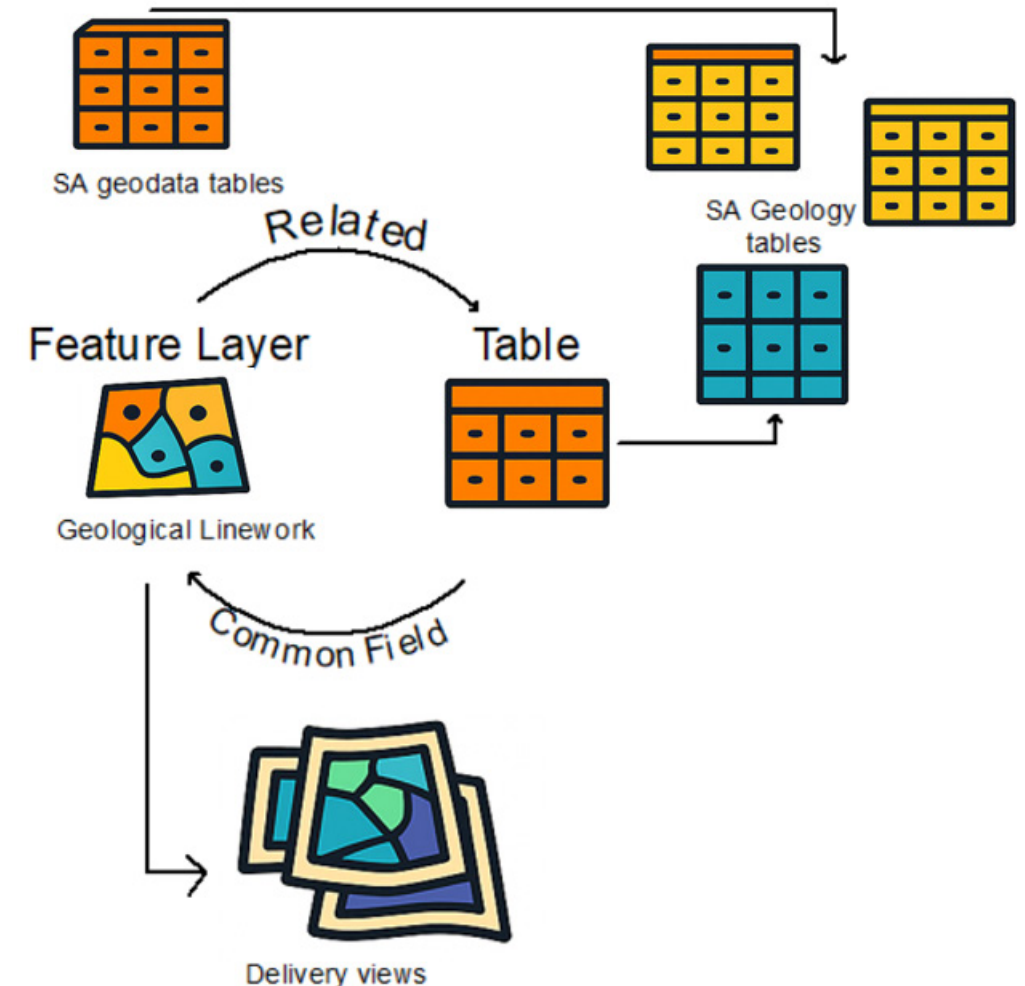
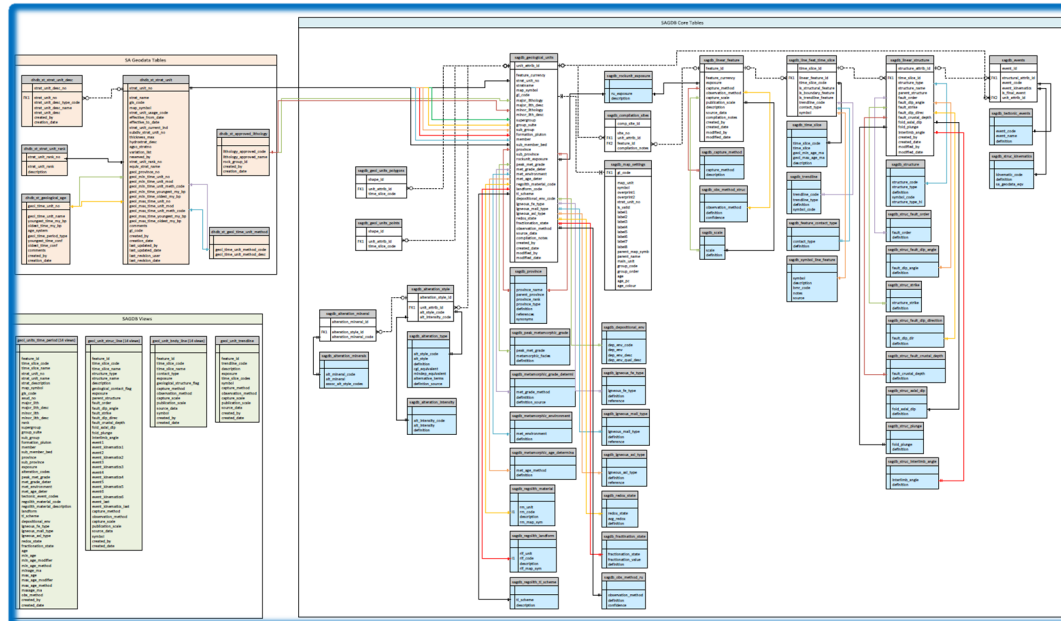


Common Field: Linear feature ID

Modern data management system solution

The key system and capability elements and design required to underpin the SADM infrastructure.

- Created a **database schema for geoscience data**, designed for normalised storage of geological observations, structural attributes, and mapping metadata.
- SADM environment to allow **compilers** access from anywhere.
- Seamless integration with **SA Geodata** tabular and spatial datasets.
- Allow simultaneous **multiuser editing** and historical archiving.
- Shared layers as **map services** with feature access capabilities.

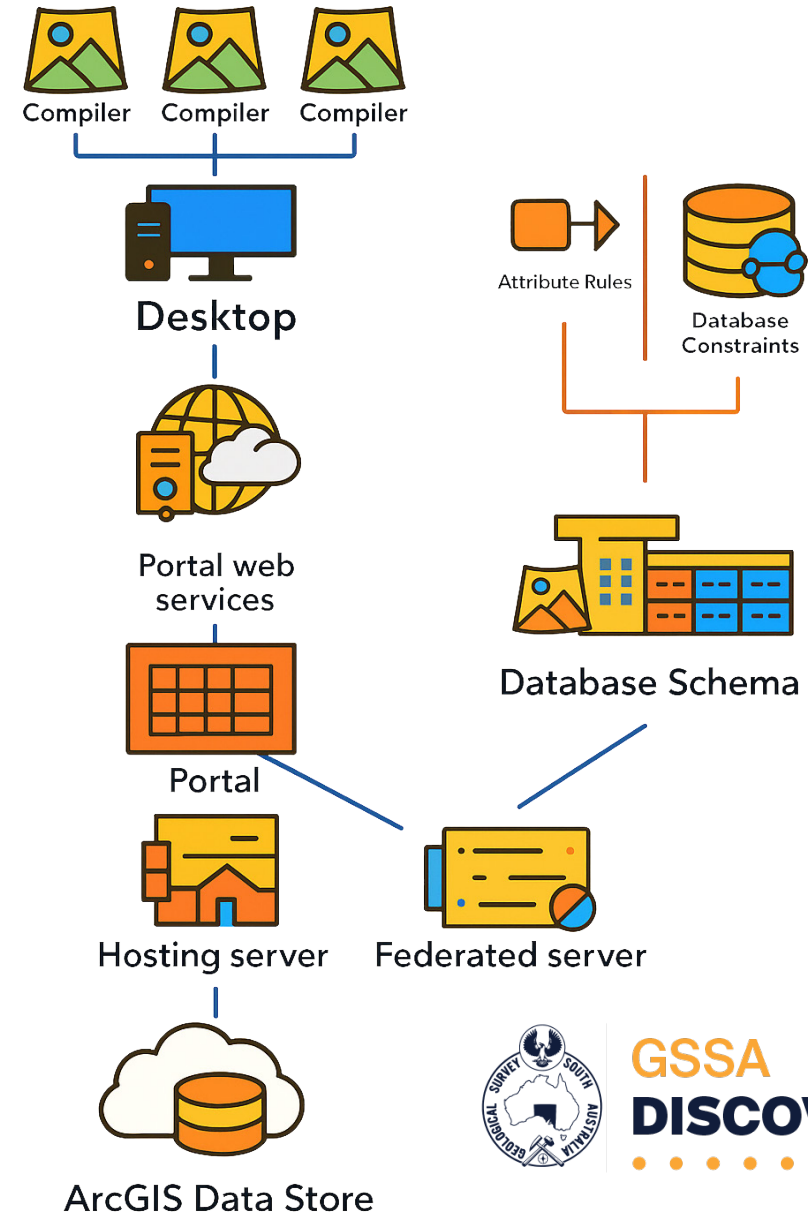


Modern data management system solution

Built on Esri ArcGIS Enterprise, SA Geology 1st edition is a cloud-deployed, relational database system delivering modern spatial and textual geological data.

- Must be able to leverage existing **Enterprise Agreement** licensing.
- The SADM project will assist in increasing the effective adoption of **modern** geospatial technology.

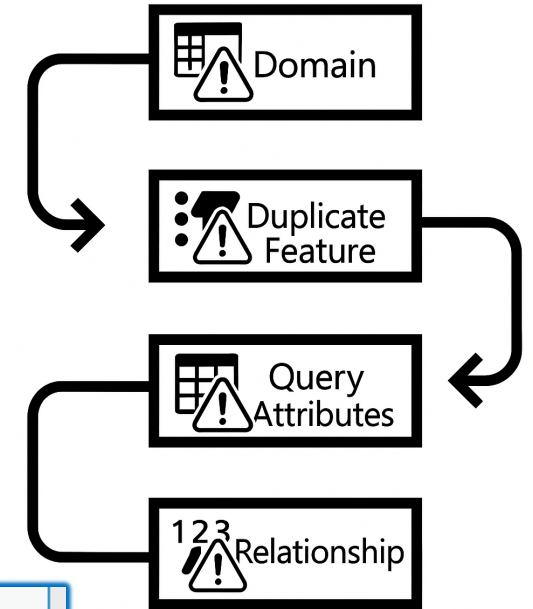
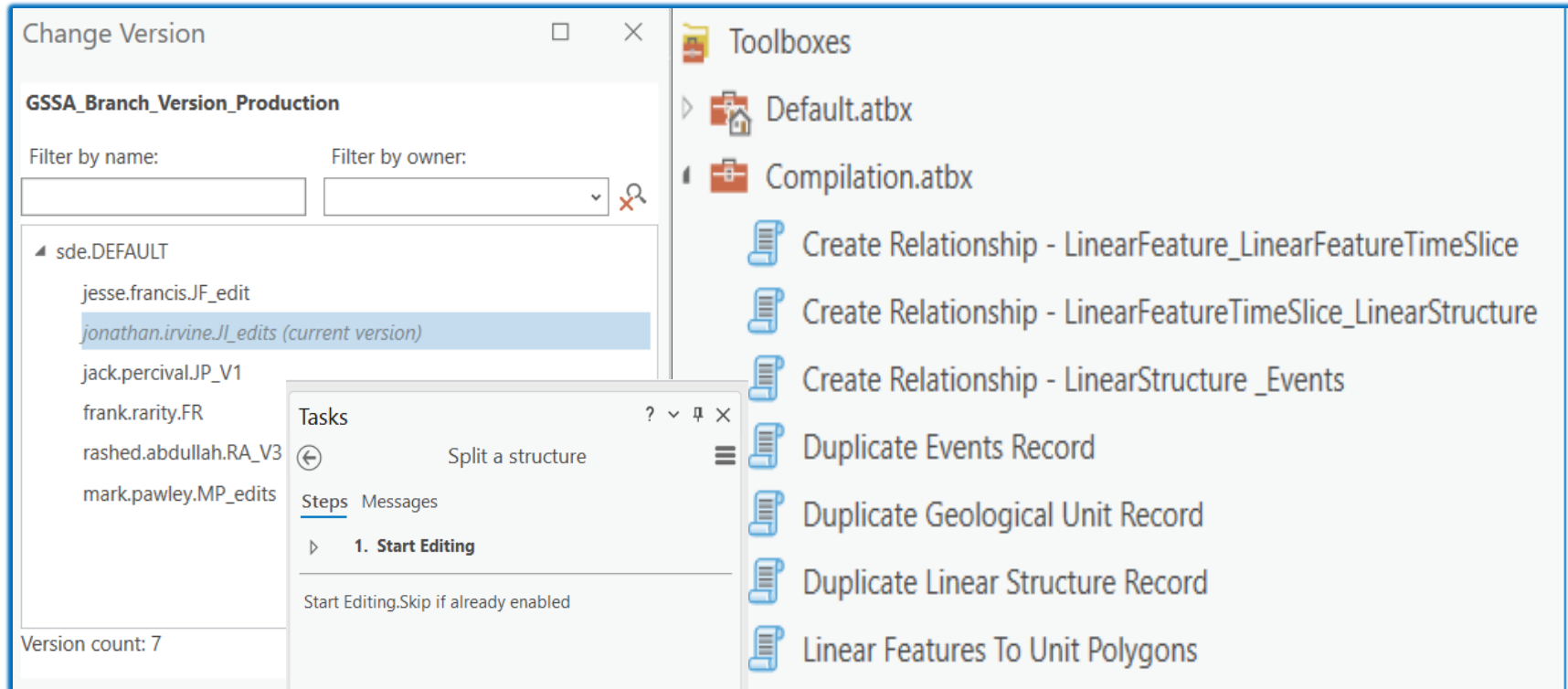
GSSA to have the full capacity of controlling SADM GIS infrastructure and managing dataset editing and publishing workflows.



Modern quality control

Goal: Efficiently capture and validate geological mapping data.

- Develop a **Services API** for mapping geologists.
- Integrate **GIS tools** for spatial data input.
- Implement **automated QC checks** (coordinate validation, attribute completeness).
- Support **multiuser data capture** with sync capabilities.

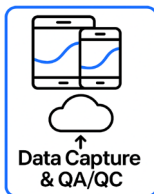


Database Schema

Modern quality control: validation

This focuses on the requirements to develop and maintain a comprehensive auditing and control system to ensure data quality, reliability and consistency.

- Design QA plans to govern data editing workflows.
- Leverage collaboration tools to facilitate registering and tracking data compilation tasks.
- Be able to record **data compilation** notes, tagged against features.
- Adopt a validation process that covers **attributes & geometry** values.
- **Validation checks** to ensure mandatory fields are not empty.



Attribute Rules/Checks

sagdb_linear_feature table (constraint rule)

1. Prevent nulling of linear_feature id i.e., PK1 "linear_feature_id ≠ <NULL>"

sagdb_geol_unit_points (validation rule)

1. **Flag a validation error if " time_slice_code= <NULL>"**
 - **Error Message:** All geological unit's points must have a time slice code.

sagdb_geol_unit_polygon (validation rule)

1. **Flag a validation error if " time_slice_code= <NULL>"**
 - **Error Message:** All geological unit's polygons must have a time slice code.

Attributes

Selection Layers

Change the selection.

- ▲ GSSA_Branch_Version_Production : sagdb_linear_featur
 - 1165584
 - 1168810
- ▲ sagdb_linear_feature_time_slice (4)
 - 1560289
 - 1560290
 - Neoproterozoic time slice
 - Neoproterozoic time slice

Field Name	Value
object_id	(Different Values)
time_slice_id	(Different Values)
linear_feature_id	(Different Values)
time_slice_code	<Null>
is_structural_feature	<Null>
is_boundary_feature	Archean-Paleoproterozoic time sli
is_trendline_feature	Early Paleoproterozoic time slice
trendline_code	Late Paleoproterozoic time slice
contact_type	Paleo-Mesoproterozoic time slice
symbol_primary	Mesoproterozoic time slice
symbol_secondary	Meso-Neoproterozoic time slice
global_id	Neoproterozoic time slice
created_user	Cambrian time slice
created_date	Ordovician-Carboniferous time sli
	Permian time slice
	Triassic time slice
	Jurassic-Cretaceous time slice
	Cenozoic time slice
	Undefined time slice
	Toondulya time slice

Auto Apply

Geoprocessing

Linear Features To Unit Polygons

Pending edits.

Parameters Environments

LinearFeatureTimeSlice

sagdb_linear_feature_time_slice

The input has a selection. Records to be processed: 3

TimeSliceCodeField

time_slice_code

TimeSliceCode

NEO

LinearFeature

sagdb_linear_feature

The input has a selection. Records to be processed: 3

Label Features

sagdb_geol_units_points

The input has a selection. Records to be processed: 1

Geol_Units_Polygons

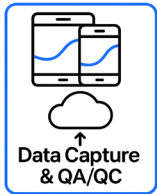
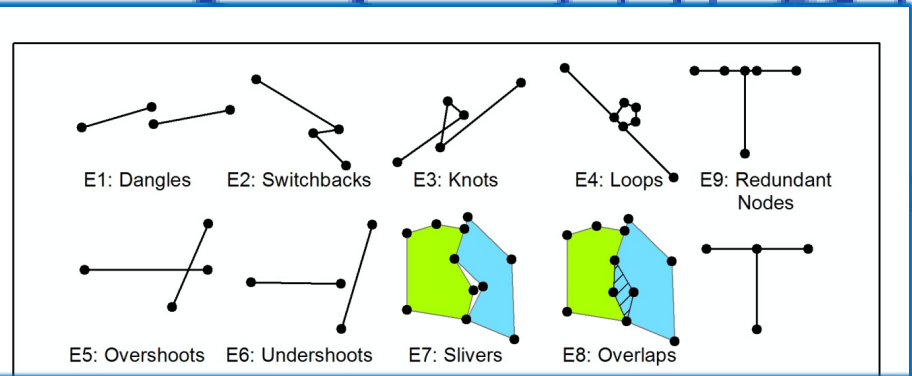
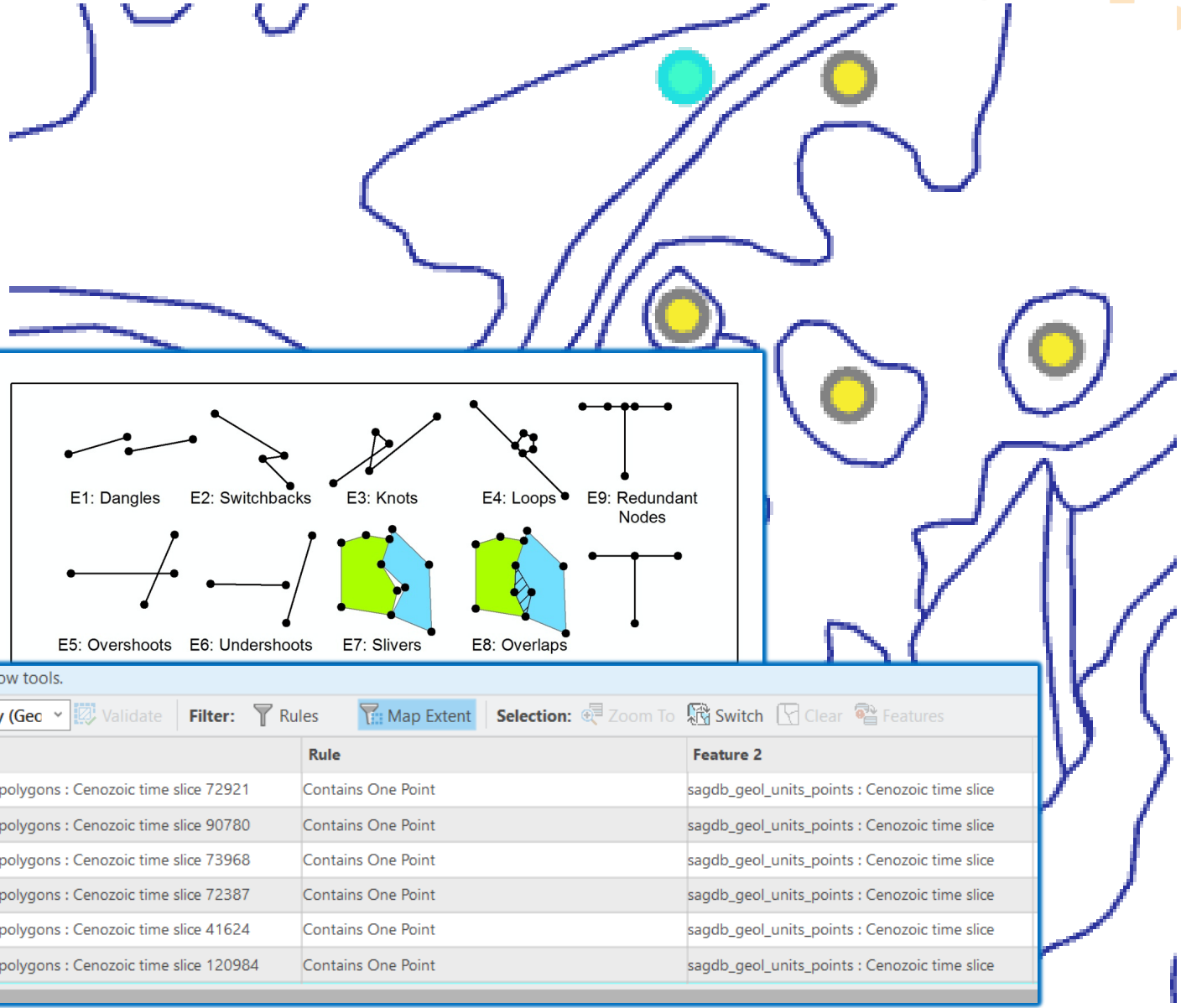
sagdb_geol_units_polygons

The input has a filter. Records to be processed: 41,550

Modern quality control: validation

Esri ArcGIS Enterprise gives us a modern, interactive Quality Assurance (QA) and editing workflows can streamline data integration, reduce manual effort, and improve confidence in spatial outputs.

- Implement **topology rules** that align with the existing SA Geology.
- Implement **attribute rules** to add logic directly to our Enterprise Geodatabase workflows.
- The number of attribute fields required to be populated during the data editing process should be kept to a minimum to reduce editing time.



SADM_Data Validation_PROD

- GSSA_Branch_Version_Production Error Layers
 - Point Errors
 - Line Errors
 - Exception
 - Error
 - Polygon Errors
 - Object Errors

Enable editing to show tools.

Source: geol_topology (Gec) Validate Filter: Rules Map Extent Selection: Zoom To Switch Clear Features

Shape	Feature 1	Rule	Feature 2
1	sagdb_geol_units_polygons : Cenozoic time slice 72921	Contains One Point	sagdb_geol_units_points : Cenozoic time slice
2	sagdb_geol_units_polygons : Cenozoic time slice 90780	Contains One Point	sagdb_geol_units_points : Cenozoic time slice
3	sagdb_geol_units_polygons : Cenozoic time slice 73968	Contains One Point	sagdb_geol_units_points : Cenozoic time slice
4	sagdb_geol_units_polygons : Cenozoic time slice 72387	Contains One Point	sagdb_geol_units_points : Cenozoic time slice
5	sagdb_geol_units_polygons : Cenozoic time slice 41624	Contains One Point	sagdb_geol_units_points : Cenozoic time slice
6	sagdb_geol_units_polygons : Cenozoic time slice 120984	Contains One Point	sagdb_geol_units_points : Cenozoic time slice

Modern quality control: Clean data is not optional!

Reliable, validated data is the foundation of a trustworthy database.

- **Constraint Rules** prevent invalid edits at the time of entry.
- **Calculation Rules** automatically compute or update attribute values during editing. This reduces manual data entry and enforces consistency.
- **Validation Rules flag** features as valid or invalid during quality control checks, allowing for later review instead of blocking edits immediately.

time_slice_code	is_structural_feature	is_boundary_feature	is_trendline_feature
Neoproterozoic time slice	No	Yes	No
Neoproterozoic time slice	No	Yes	No
Undefined time slice	No	Yes	No
Undefined time slice	No		
<Null>	<Null>		
<Null>	<Null>		

Error Message:
All geological lines must have a time slice code

Flag a validation error

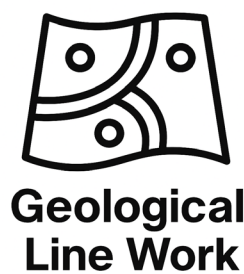
symbol	time_slice
28	NULL

sagdb_line_feat_time_slice



Validation Rule

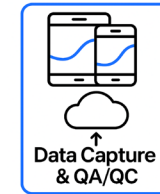
Rule Name	Description
LinearFeatureId_IsNull	Record should contain linear_feature_id
LinearFeatureId_IsNull	Record should contain linear_feature_id
LinearFeatureId_IsNull	Record should contain linear_feature_id
TimeSliceId_IsNull	time_slice_id should not be null
LinearFeatureId_IsNull	Record should contain linear_feature_id



Modern quality control: Dashboards

Facilitating and tracking data compilation tasks and issues = **Dashboards!**

- Minimum attribution goals achieved!



SADM Structure Lines

Esri, USGS | Esri, TomTom, Garmin, FAO, NOAA, USGS

linear_feature_id	time_slice_code	time_slice
{000673F8-251E-4DFB-B5DC-13F0EF7F9BAE}	LPR	Late Paleoproterozoic
{000953D6-65DD-4F6B-90BC-AD4B392C98CE}	LPR	Late Paleoproterozoic
{000E811F-ACB0-460F-B273-FD2996715655}	ARP	Archean-Paleoproterozoic
{00175E8E-9987-4043-88EE-11105D36EFF9}	PMP	Paleo-Mesoproterozoic
{001B8B8D-0B75-4A74-9B50-CD43D1BF59A7}	LPR	Late Paleoproterozoic

SADM Trendlines

Esri, USGS | Esri, TomTom, Garmin, FAO, NOAA, USGS

linear_feature_id	time_slice_code
{000E2A15-370D-46BC-896C-1EB60BF2814B}	
{001262F4-33EF-48C0-B5FF-3B9144D89375}	
{001C9B22-803F-4D7A-AF77-4A33CA5790F6}	
{001FE640-BAB1-4033-865F-3401E4F7135A}	
{002003B4-9C02-40B4-84E4-8AA684BE56AD}	

SADM Boundary Lines

Esri, USGS | Esri, TomTom, Garmin, FAO, NOAA, USGS

linear_feature_id	time_slice_code	time_slice	contact_type	description	created_user
{00003BE9-45CA-4E68-B0A4-4099013D0280}	CEN	Cenozoic time slice	N/A	Geological boundary position accurate	Xenios.Markou2
{0000D08A-4491-47D5-9819-B7A4AE40B95A}	CEN	Cenozoic time slice	N/A	Geological boundary position accurate	Xenios.Markou2
{000127D6-4723-42C0-A484-1EBF882D804}	CEN	Cenozoic time slice	N/A	Geological boundary position accurate	Xenios.Markou2
{00012D91-BB2F-42A3-B9E4-4EEFA396B7E}	CEN	Cenozoic time slice	N/A	Geological boundary position accurate	Xenios.Markou2
{0001A687-E1D3-4C0E-95D9-EF65E842595D}	CEN	Cenozoic time slice	N/A	Geological boundary position accurate	Xenios.Markou2

9498

Linear Features with Missing Trendline Type or Time Slice Code

279.10K

Linear Features with Missing Contact Type or Time Slice Code

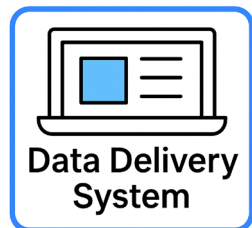
Features by Created User

created_user	Count	Percentage
Xenios.Markou2	276,720	99.15%
Jonathan.Irvine	1,970	0.7%
Frank.Rarity	0	0%
Rashed.Abdullah	0	0%
Mark.Pawley	0	0%
Jack.Percival	0	0%
Michael.McMaster	0	0%

SA Geology delivery

Goal: Deliver data through SARIG and modern web services.

- Implement **Modern API and OGC-compliant services** (WMS, WFS).
- Provide **downloadable datasets** in standard formats.
- Integrate with **SARIG** for visualisation and query.
- Modern **machine-ready** geoscience.



Government of South Australia
Department for Energy and Mining

COLLECTION

South Australia Discovery Mapping Project

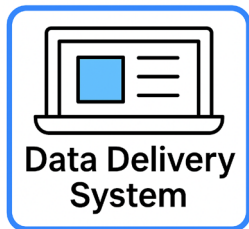
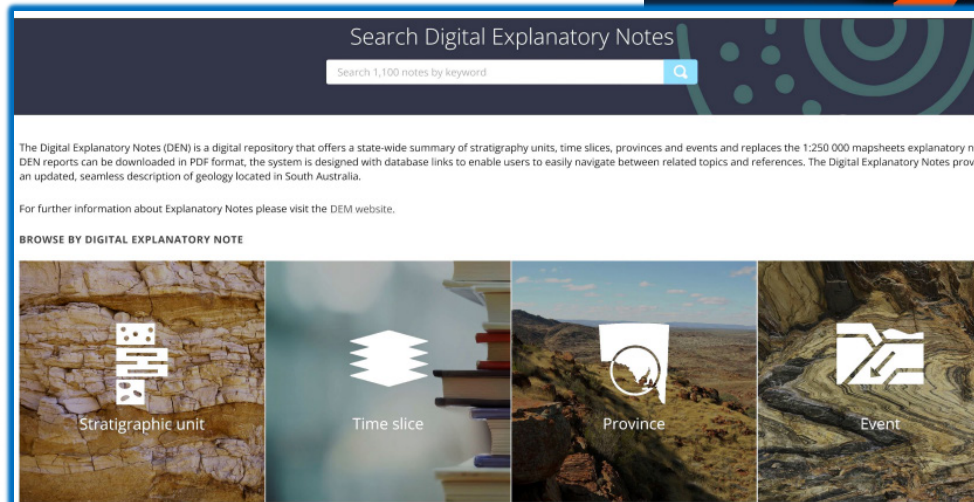
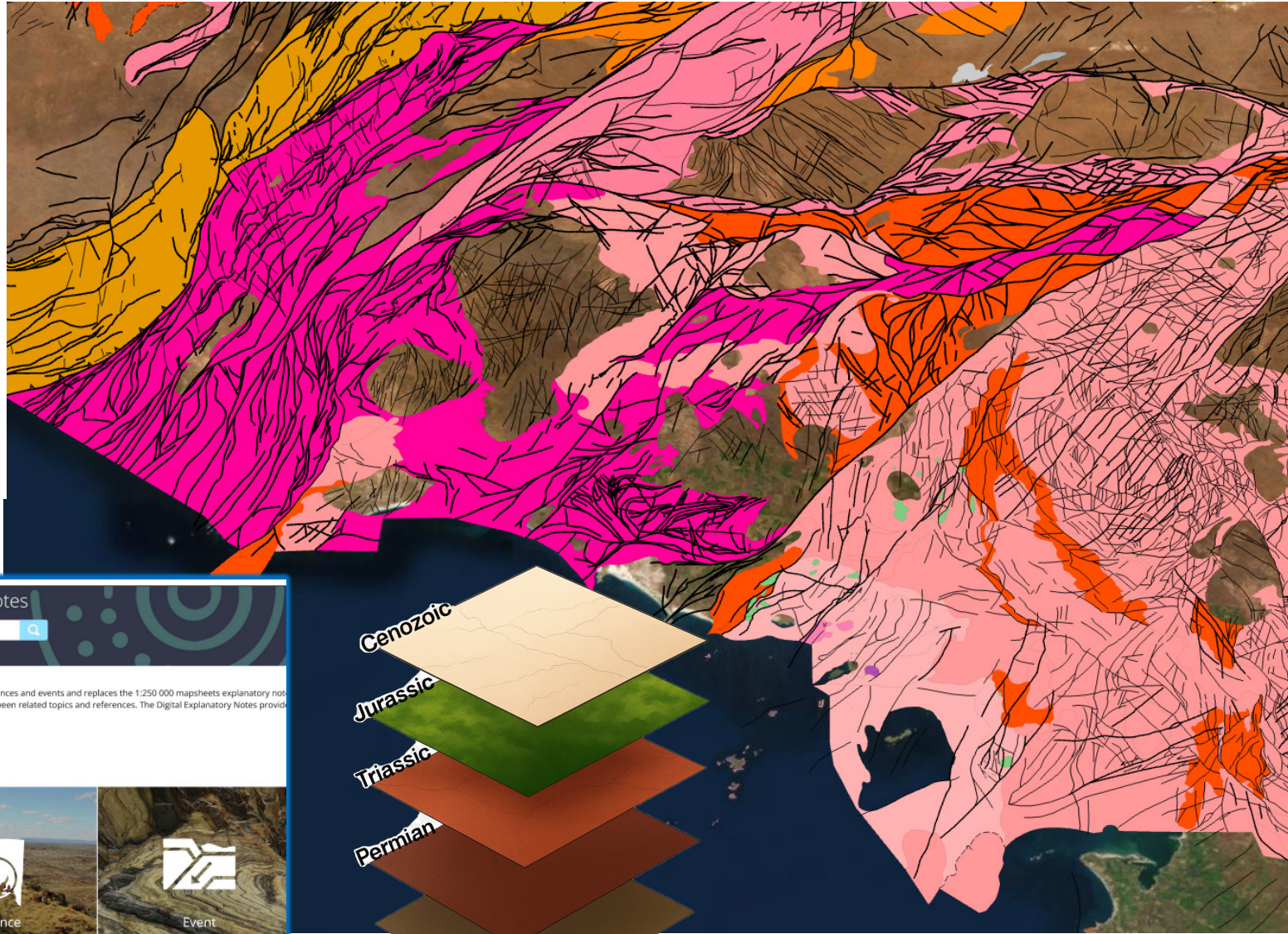
Geological Survey of South Australia

[Get started](#)



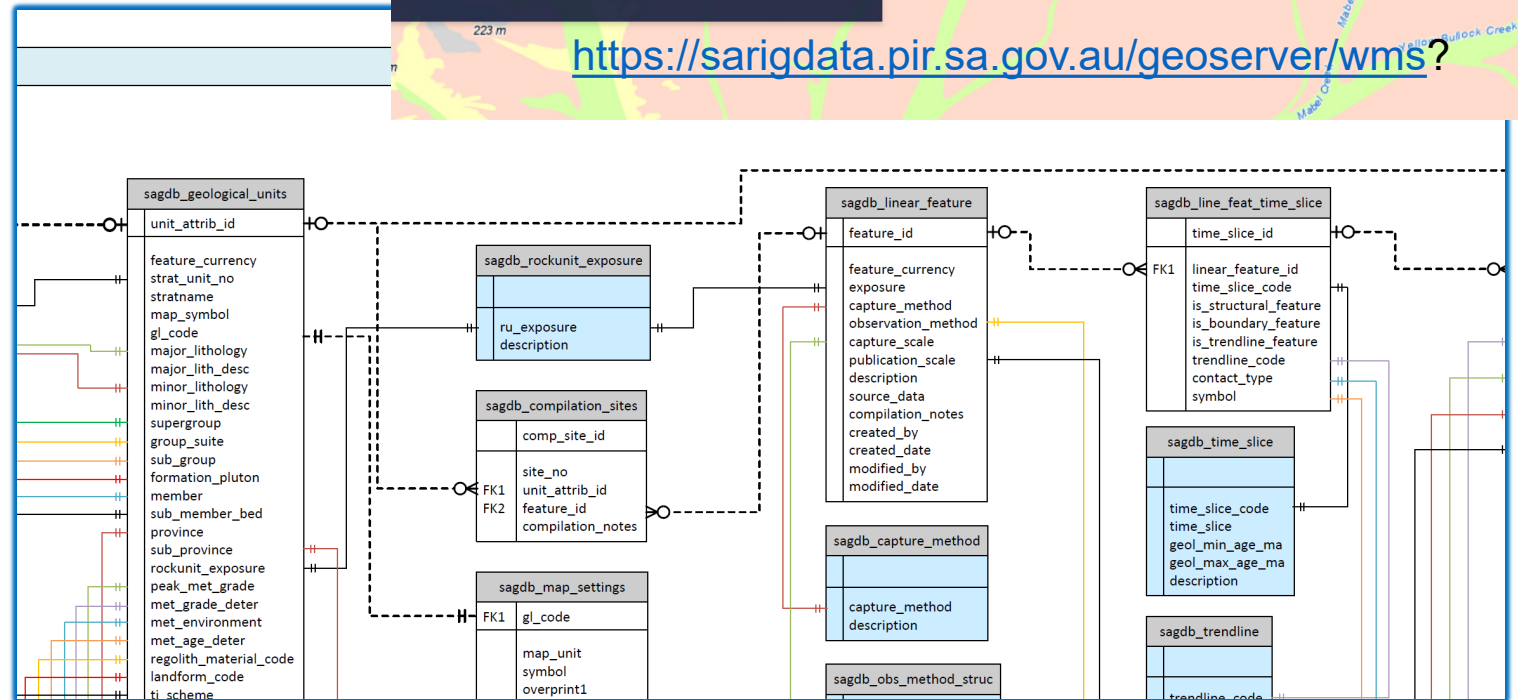
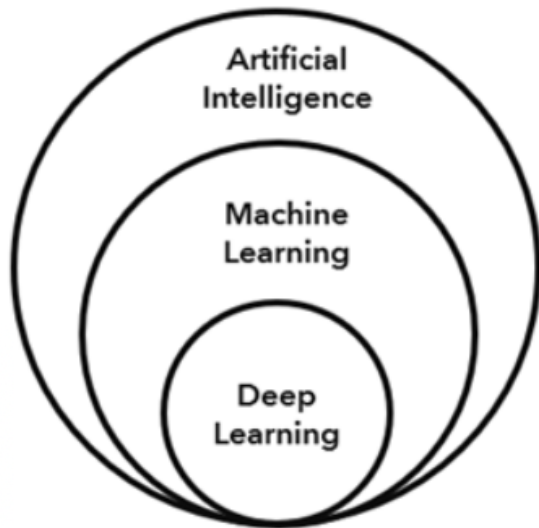
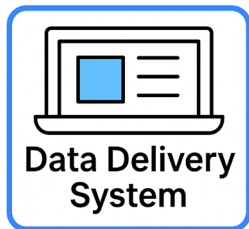
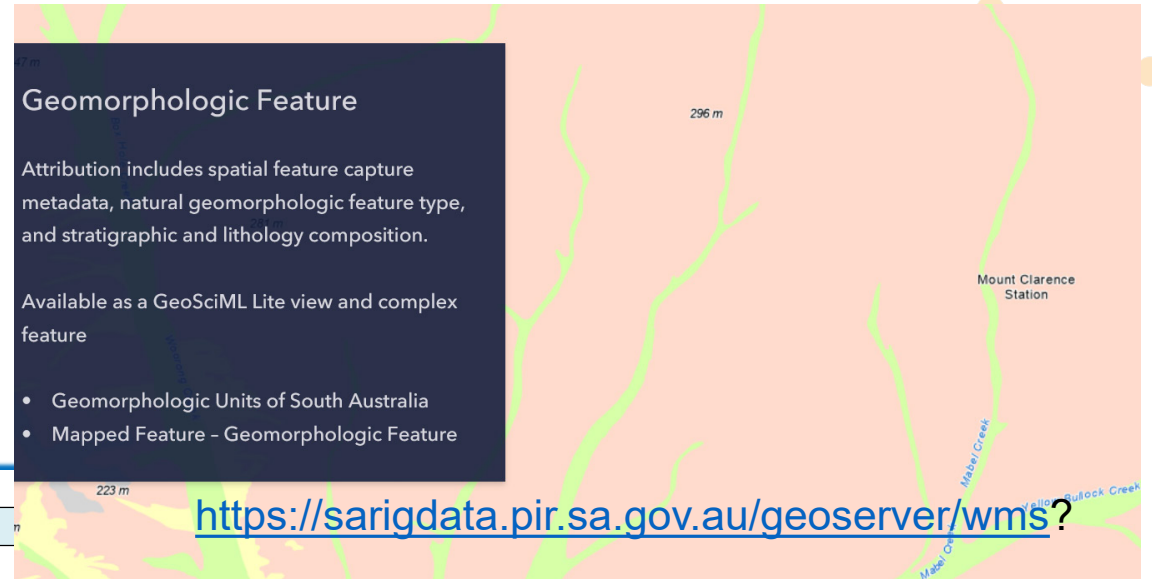
SA Geology delivery: What it looks like

- Delivered a new digital explanatory notes system, providing the best available stratigraphic information and replacing individual map sheet notes
- Statewide, seamless Integrated interpreted and exposed geological map layers.
- Time constrained layer set.
- Highest available resolution data.



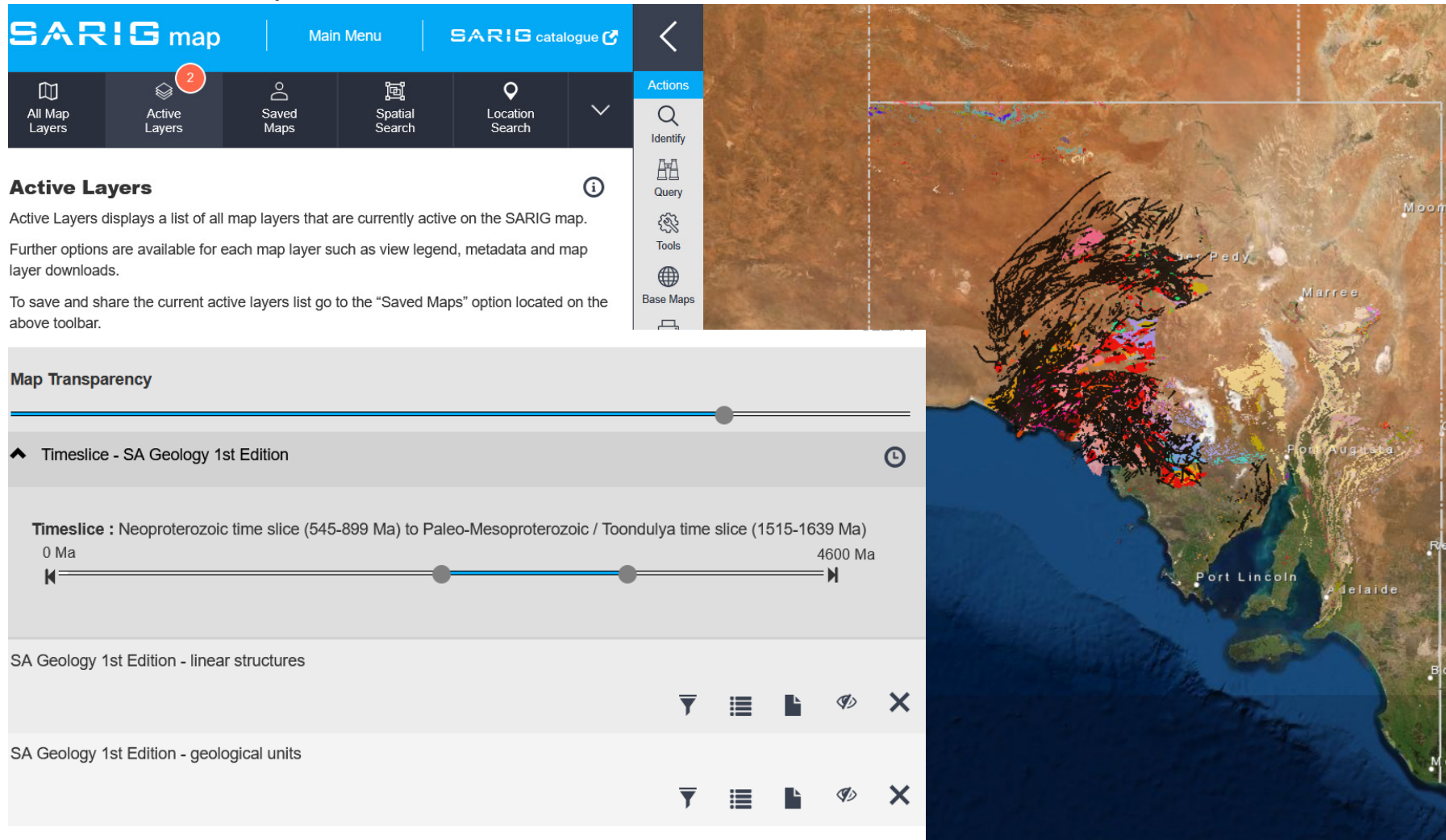
SA Geology delivery: What it looks like

- More robust data and metadata (quality/consistency/quantity).
- More attributes and internally consistent datasets.
- Readily updateable and flexible.
- Consistent stratigraphy across regions.
- Update and fully attribute/define stratigraphic units.
- Data formatted/international standards and machine readable.

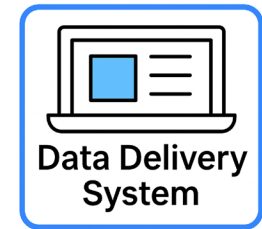


SA Geology delivery: SARIG

- Generating new detailed outcrop and interpreted geological map layers for delivery via SARIG and web services.
- Deliver a digital explanatory notes system, providing the best available stratigraphic information and replacing individual map sheet notes.

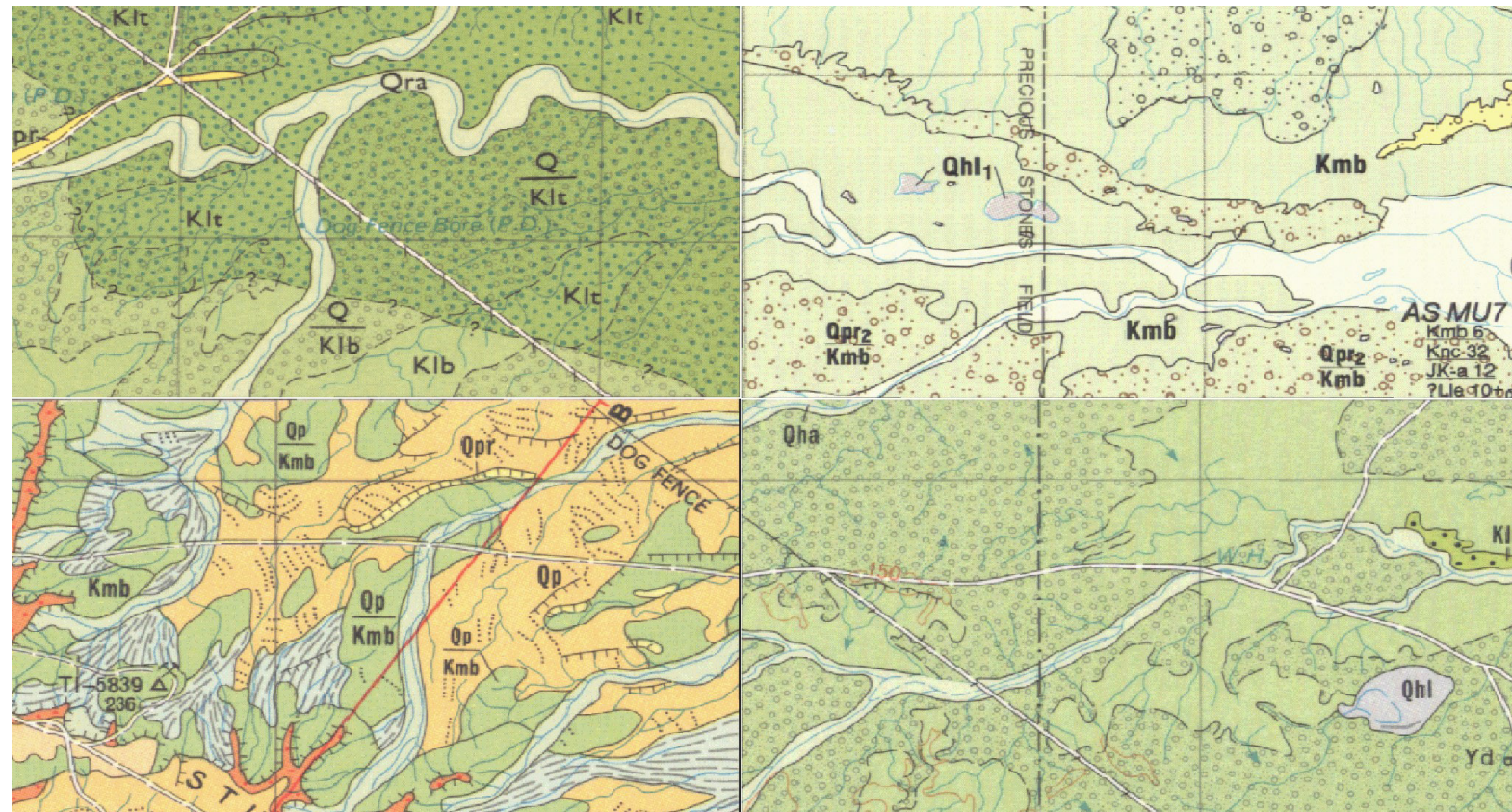
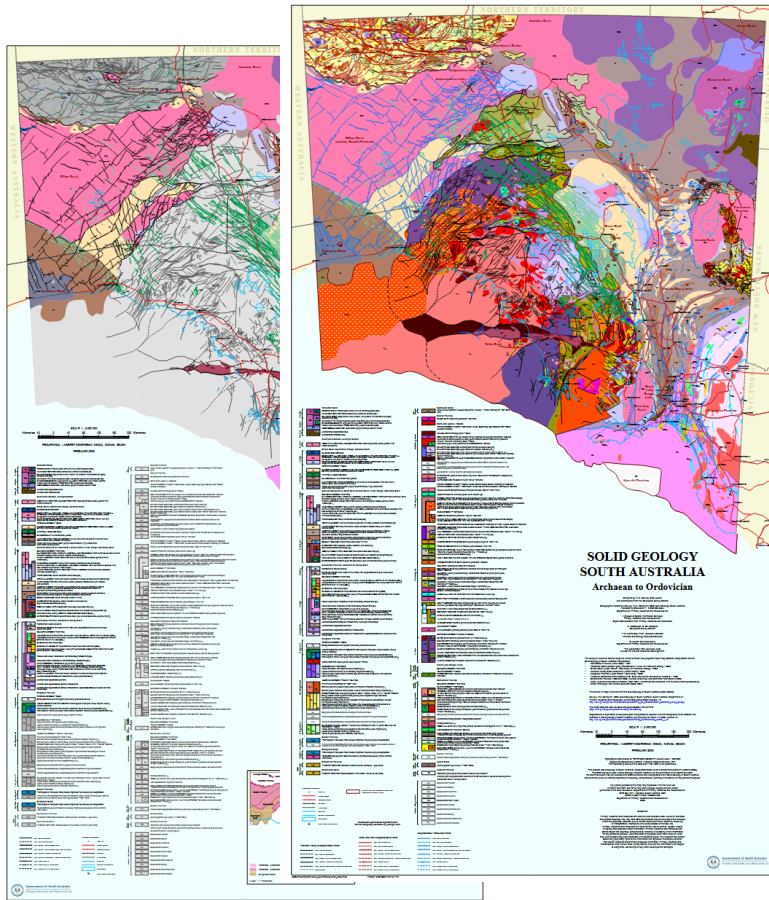


The screenshot displays the SARIG map interface. At the top, there is a blue header with the SARIG logo and navigation options like 'Main Menu' and 'SARIG catalogue'. Below the header is a toolbar with icons for 'All Map Layers', 'Active Layers' (with a red notification bubble containing the number 2), 'Saved Maps', 'Spatial Search', and 'Location Search'. A sidebar on the left contains an 'Active Layers' section with an information icon and a paragraph of text: 'Active Layers displays a list of all map layers that are currently active on the SARIG map. Further options are available for each map layer such as view legend, metadata and map layer downloads. To save and share the current active layers list go to the "Saved Maps" option located on the above toolbar.' Below this is a 'Map Transparency' slider and a 'Timeslice - SA Geology 1st Edition' section with a timeline from 0 Ma to 4600 Ma. At the bottom, there are two layer entries: 'SA Geology 1st Edition - linear structures' and 'SA Geology 1st Edition - geological units', each with a set of control icons (filter, list, document, eye, close). The main map area shows a satellite-style map of South Australia with overlaid geological data, including a large black and red area in the west and various colored polygons and lines elsewhere. Labels on the map include 'Moomb', 'Marree', 'Port Augusta', 'Port Lincoln', and 'Adelaide'.



SA Geology: future improvements to seamless data

- We need to deal with **adjoining geological interpretations** of map sheets that may be 40+ years apart.
- Integration of the existing **solid geology** layers be incorporated into the rock unit feature classes within the time constrained layers.
- Stay tuned for the **Eastern GCAS** integration next year.



SA Geology: future improvements to seamless data

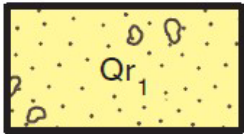
- Eliminated and reduced the number of “**piggyback**” units within the spatial data.
- Underlying older rock units need to be extended out under younger units within time layers to eliminate the existing 100k geology **cookie-cut data**.
- Some units still occur for those units that exist within a single the Cenozoic time slice.



SA Geology: future improvements

- Can we extrapolate an extent for **unmapped units**?
- Still work to be done on removing **inconsistent stratigraphy**.
- Still considering how to display the varying geological themes.

PLEISTOCENE-HOLOCENE

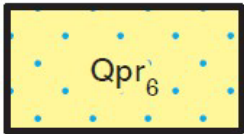


QUATERNARY REGOLITH/COLLUVIAL UNIT 1: Quaternary gibber-mantled colluvium. Based on Q on MURLOOCOPPIE.

PLEISTOCENE



PLEISTOCENE REGOLITH/COLLUVIAL UNIT 5: Pleistocene red sand with maghemite gravel veneer, typically mulga-covered.



PLEISTOCENE REGOLITH/COLLUVIAL UNIT 6: Pleistocene ironstone gravel spreads on alluvium and colluvium. Based on blue dot overprint within Qa on CURDIMURKA, Q2 on KINGOONYA.



PLEISTOCENE CALCRETE: Undifferentiated Pleistocene calcrete.

Strat Name	STRATNO	SADM Status	Timeslice
Aristarchus Metaperidotite	6985	No Mapped Units	ARP
Devils Playground Volcanics	6656	No Mapped Units	ARP
Eba Formation	5443	No Mapped Units	ARP
Mullina Volcanics Member	6392	No Mapped Units	ARP
Apamurra Formation	3250	No Mapped Units	CAM
Cootanoorina Formation	3476	No Mapped Units	CAM
Hawker Group	3634	No Mapped Units	CAM
Hideaway Well Member	3639	No Mapped Units	CAM
Linns Springs Member	3751	No Mapped Units	CAM
Mount Mantell Member	3895	No Mapped Units	CAM
Moyles Chert Marker Bed	3914	No Mapped Units	CAM
Ouldburra Formation	4013	No Mapped Units	CAM
Parakeelya Alkali Member	4028	No Mapped Units	CAM
Second Plain Creek Member	4793	No Mapped Units	CAM
Six Mile Bore Member	4519	No Mapped Units	CAM
Third Plain Creek Member	4204	No Mapped Units	CAM
Wallatina Member	4262	No Mapped Units	CAM
Winnitiny Creek Member	4541	No Mapped Units	CAM
Mirikata Formation	3827	No Mapped Units	CEN
Loongana Formation	5379	No Mapped Units	JUR
Madura Formation	3767	No Mapped Units	JUR

- Mesoproterozoic time slice (1250-1514Ma)
- Mesoproterozoic time slice (1250-1514 Ma) - linear structures
- Mesoproterozoic time slice (1250-1514 Ma) - boundaries
- Mesoproterozoic time slice (1250-1514 Ma) - geological units (Overprint)
- Mesoproterozoic time slice (1250-1514 Ma) - geological units (Mapunit)
- Mesoproterozoic time slice (1250-1514 Ma) - geological units (Age)

SA Geology summary

- The GSSA has upgraded to a next generation platform for Mapped geology.
- From compilation to release the GSSA is ensuring timely updates and data-rich products.
- The integration of spatial data and geological notes delivers a smarter way to understand our geology.
- South Australia can unlock its competitive edge with machine-ready geoscience.

The image is a collage illustrating the integration of traditional and modern geoscience. On the left, there are several geological maps: a topographic map, a geological map with a legend, and a detailed geological map with various colored units and structural features. In the center, a SARIG catalogue entry for the St Peter Suite (Yp) is displayed. The entry includes the following information:

- St Peter Suite (Yp)** (Download report)
- Approved: 29 Apr 2025
- Description: Granite; monzogranite; granodiorite; diorite; amphibolite; dolerite; local lamprophyre. Comagmatic suite with magma mingling and magmatic layering. Calc-alkaline, I-type, 1633-1608 Ma.
- ASUD Stratigraphic number: [24502](#)
- Rank: ASUD definition card exists
- Parent unit: Palaeoproterozoic rocks (Y)
- Child unit(s): [St Francis Granite \(Lpf\)](#), [St Peter Suite unit 1 \(Yp1\)](#), [St Peter Suite unit 10 \(Yp10\)](#), [St Peter Suite unit 2 \(Yp2\)](#), [St Peter Suite unit 3 \(Yp3\)](#), [St Peter Suite unit 4 \(Yp4\)](#), [St Peter Suite unit 5 \(Yp5\)](#), [St Peter Suite unit 6 \(Yp6\)](#), [St Peter Suite unit 7 \(Yp7\)](#), [St Peter Suite unit 8 \(Yp8\)](#), [St Peter Suite unit 9 \(Yp9\)](#)
- Geological province(s): [Gawler Craton](#)

On the right, there is a photograph of a person working at a computer workstation. In the bottom right corner, the GeoSciML logo is visible, featuring a stylized globe and the text "<GeoSciML/>".

Disclaimer

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Acknowledgement of Country

As guests here on Kurna land, the Department for Energy and Mining (DEM) acknowledges everything this department does impacts on Aboriginal country, the sea, the sky, its people, and the spiritual and cultural connections which have existed since the first sunrise. Our responsibility is to share our collective knowledge, recognise a difficult history, respect the relationships made over time, and create a stronger future. We are ready to walk, learn and work together.



DISCOVERY DAY

