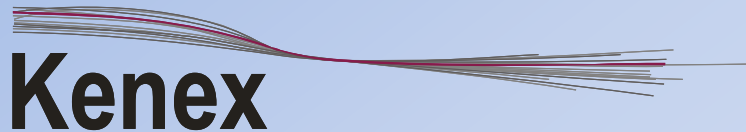


# Kenex

**EXPLORATION TARGETING  
USING GIS: MORE THAN A  
DIGITAL LIGHT TABLE**

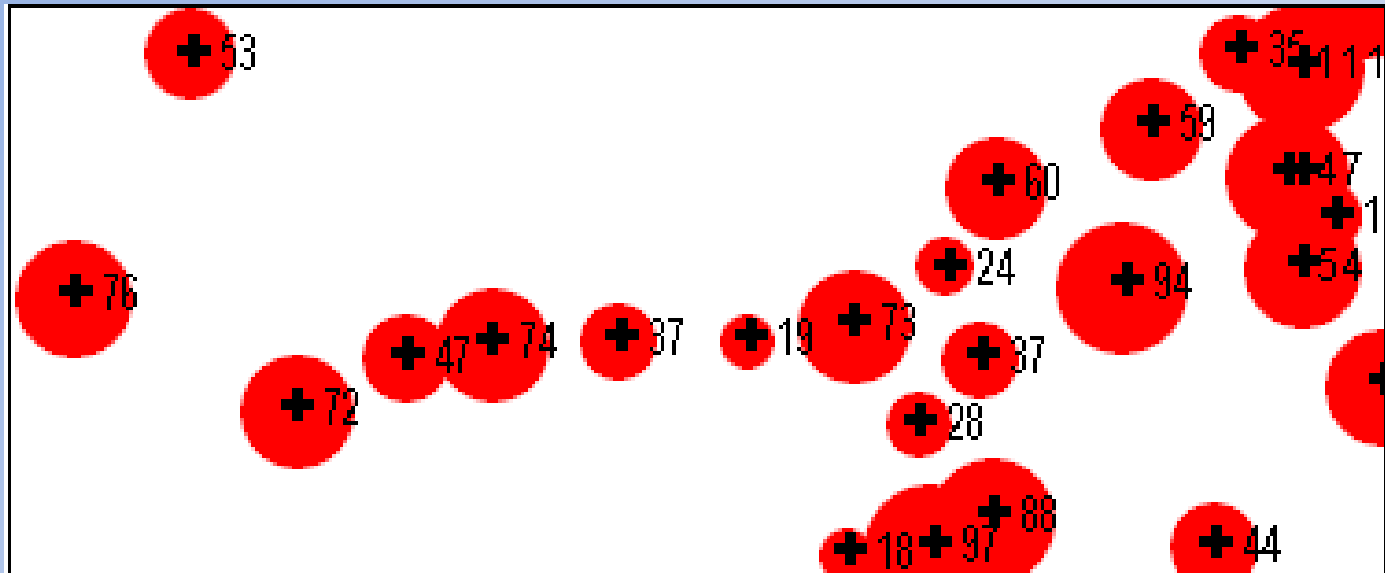


# You Can Do More With a GIS

- Taking Spatial Data and Information and Using New Technology and Research Add Value by Combining Knowledge of Process and Data.
- Spatial Data Modelling Allows Prediction.
- This Creates Business Opportunities and Better Management of Current Operations.
- Works with Industries Who Operate in the Spatial World:
  - Minerals, Agriculture, Forestry, Energy.....

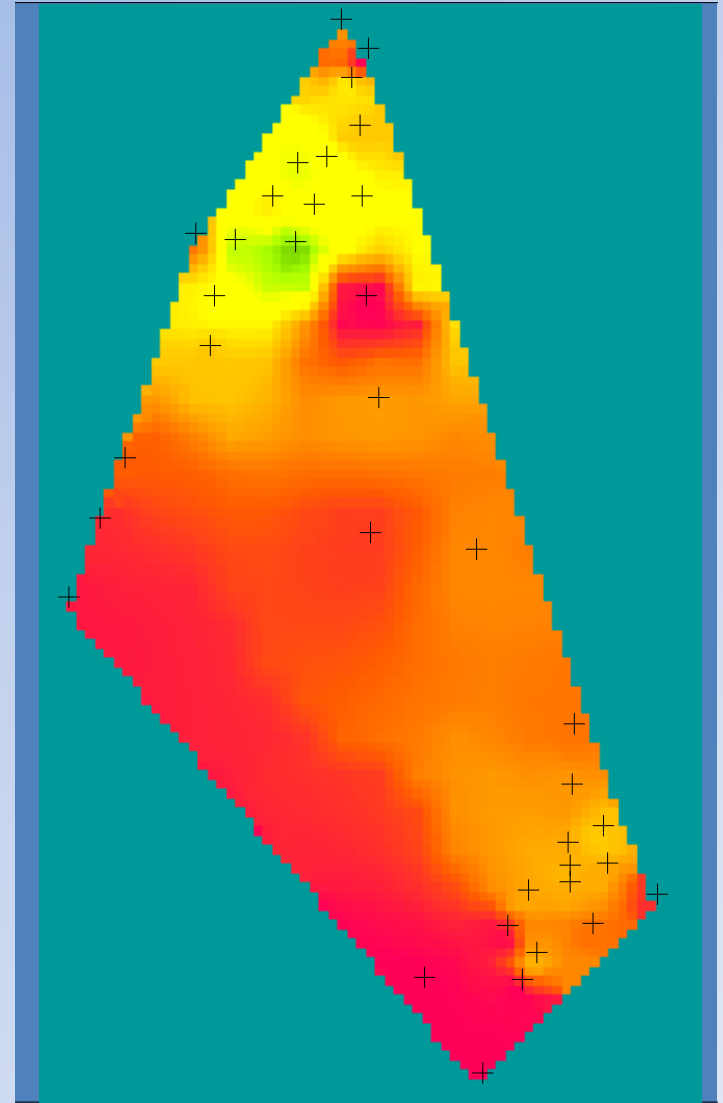
# Types of Modelling

Maps that Highlight Important Single Features or Values



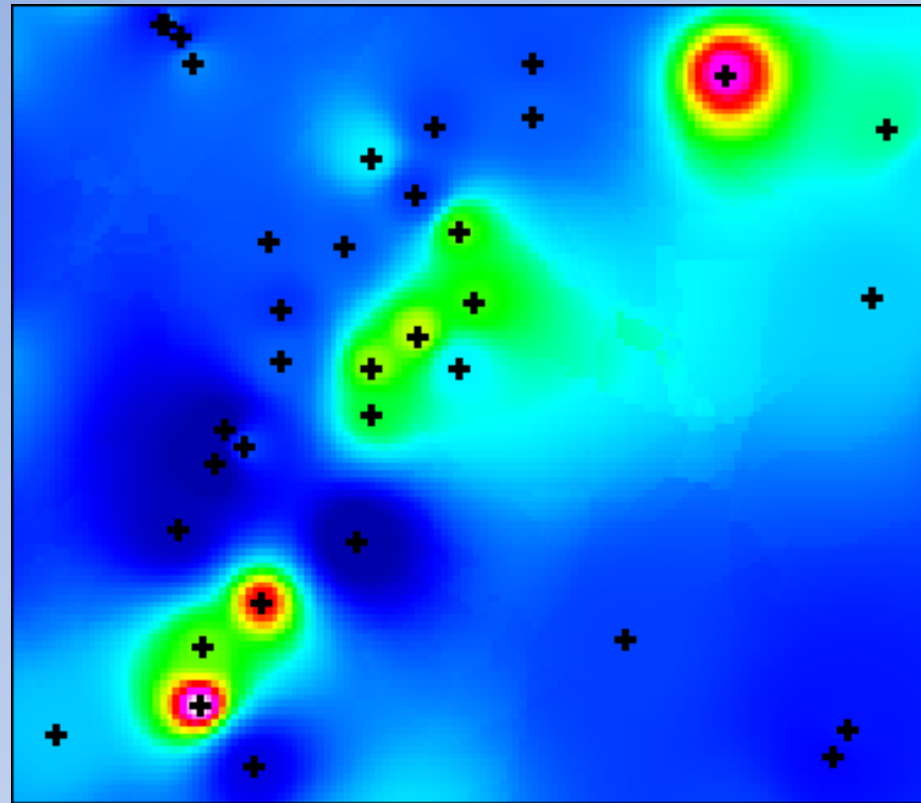
# What Is Spatial Modelling?

- Estimating New Points From Point Data
- e.g. DTM From Spot Heights
- Creating Model of a Land Surface
- Gridding
- Data Interpolation



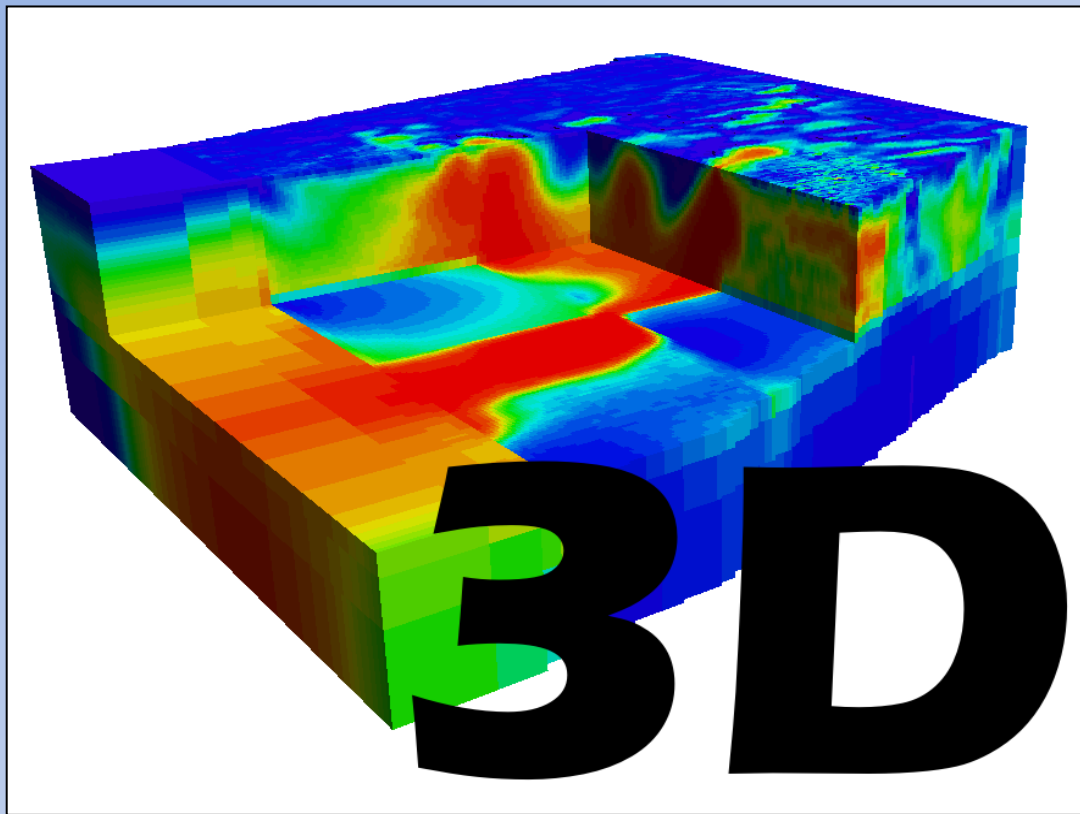
# Types of Modelling

Basic Single Variable Modelling Using Interpolation to Predict Values Between Measured Points

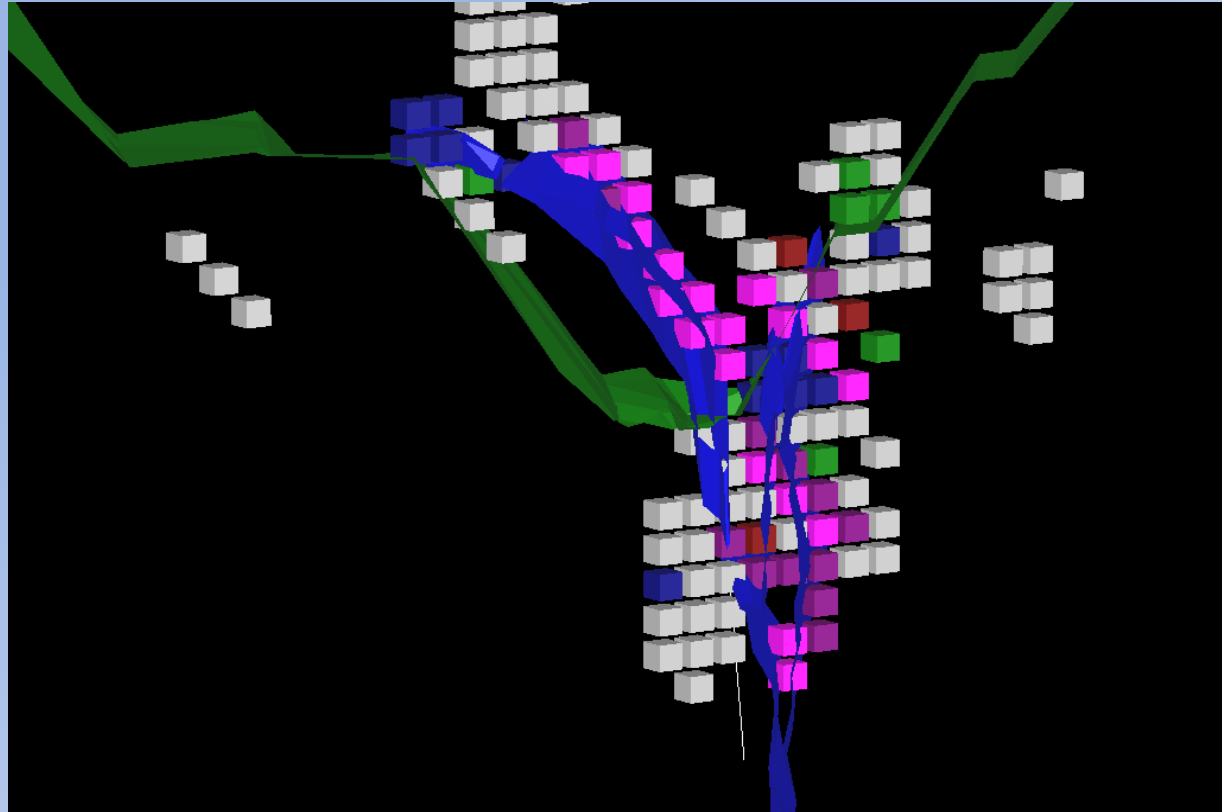


# Types of Modelling

3D Modelling of Geology or Structures and 4D Physical and Chemical Modelling of Fluid Flow and Chemical Reactions



# 3D Block Modelling



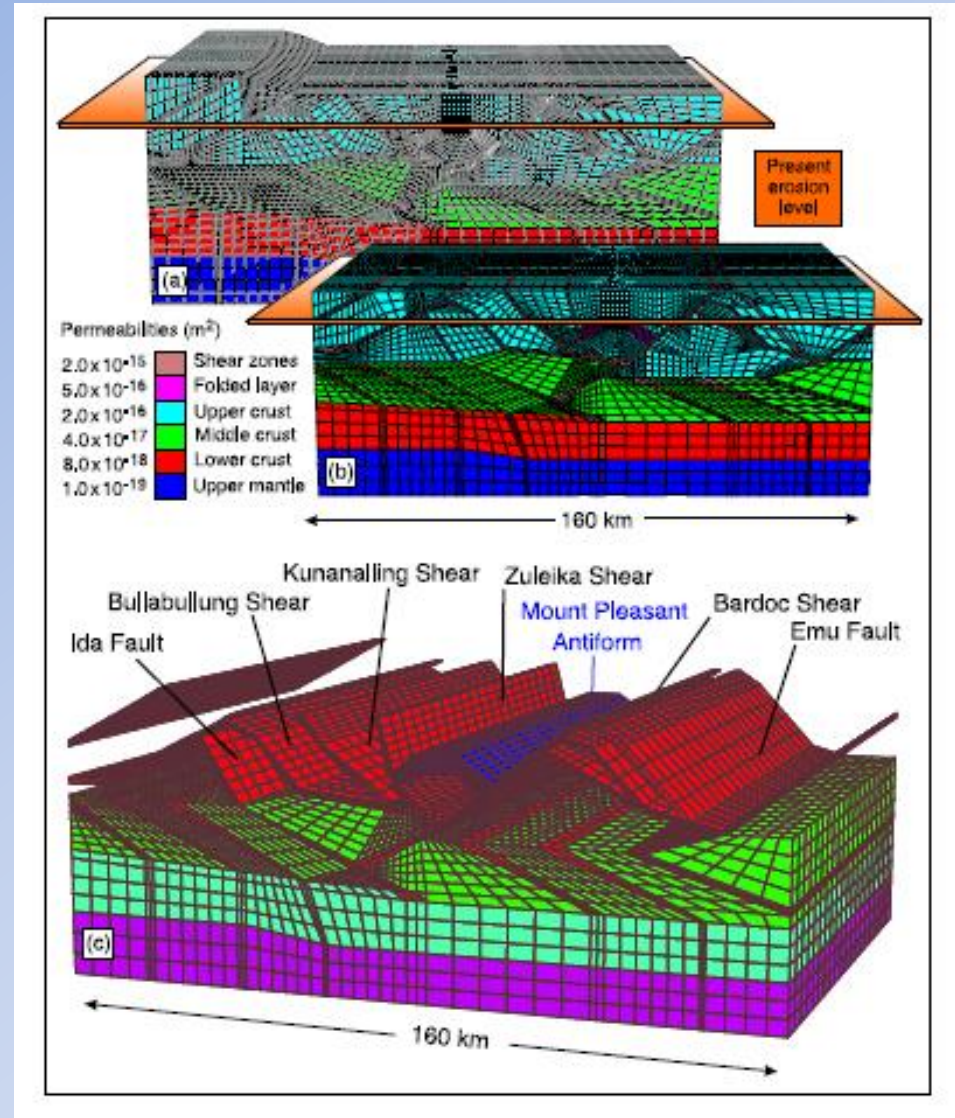
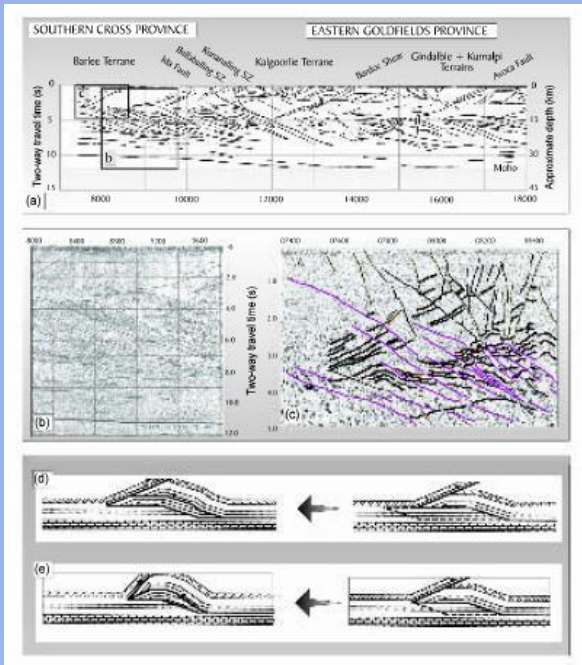
Resource

Estimation And  
Preliminary Pit

Optimisation

**Kerex**

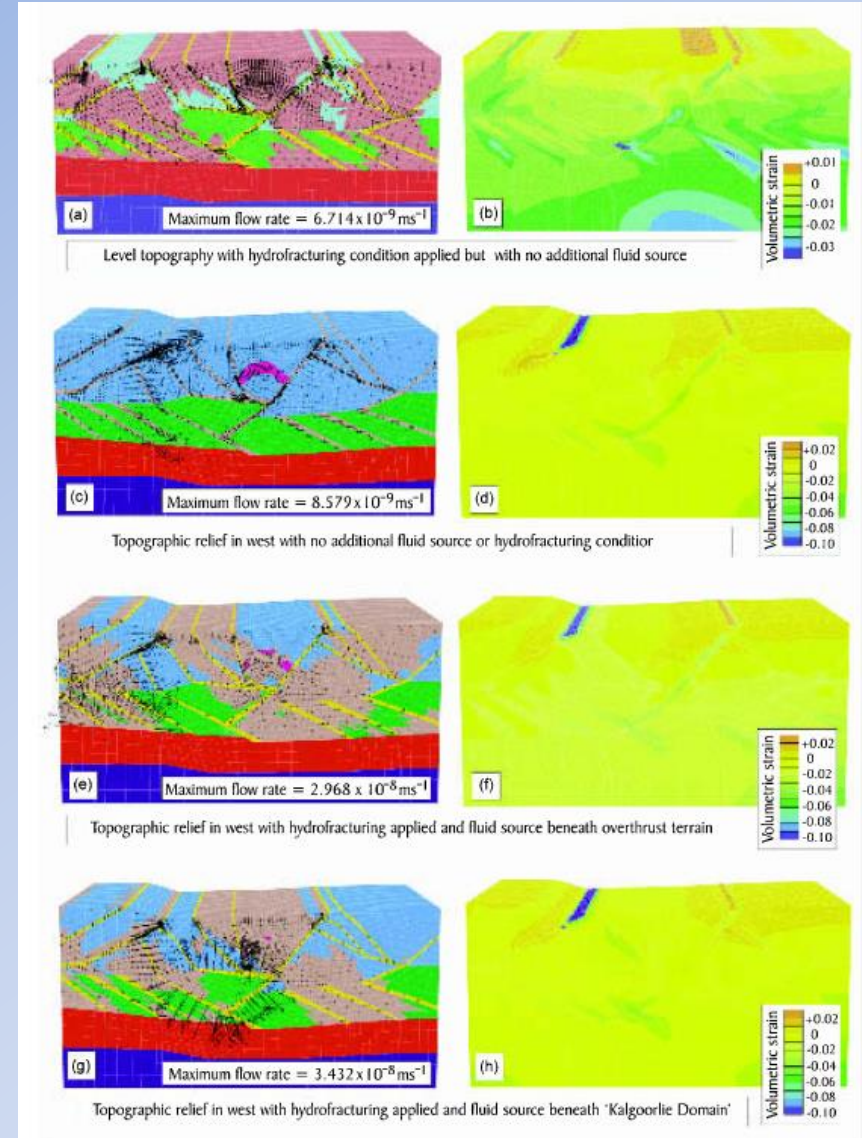
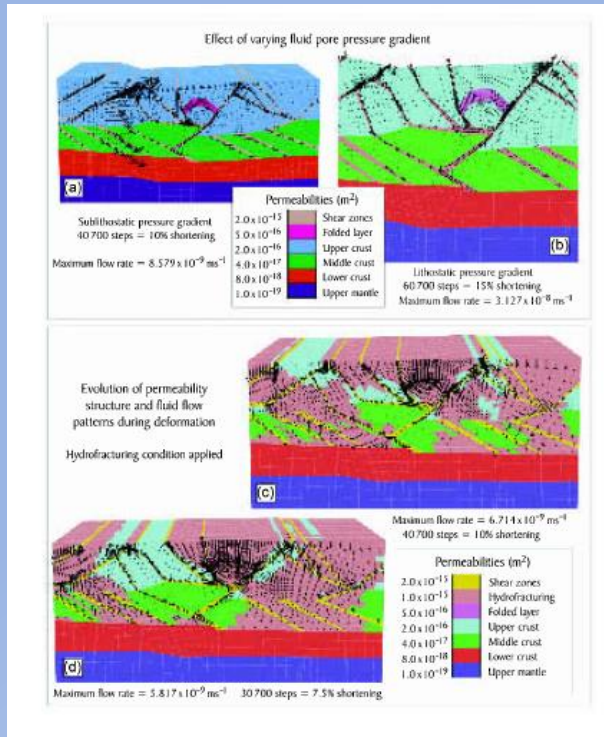
# 3D Geological Modelling



Map 3D Geology  
Using Surface  
Geology and  
Geophysics.

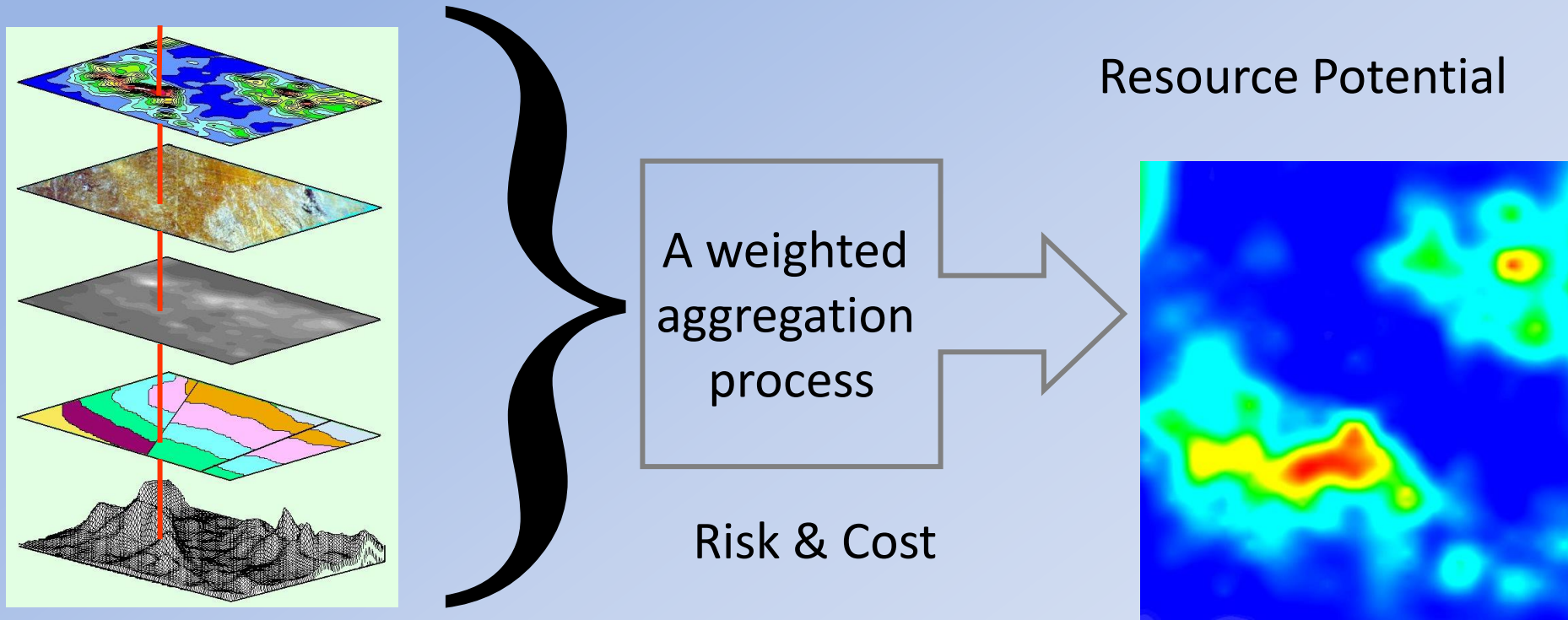


# 3D Numerical Modelling



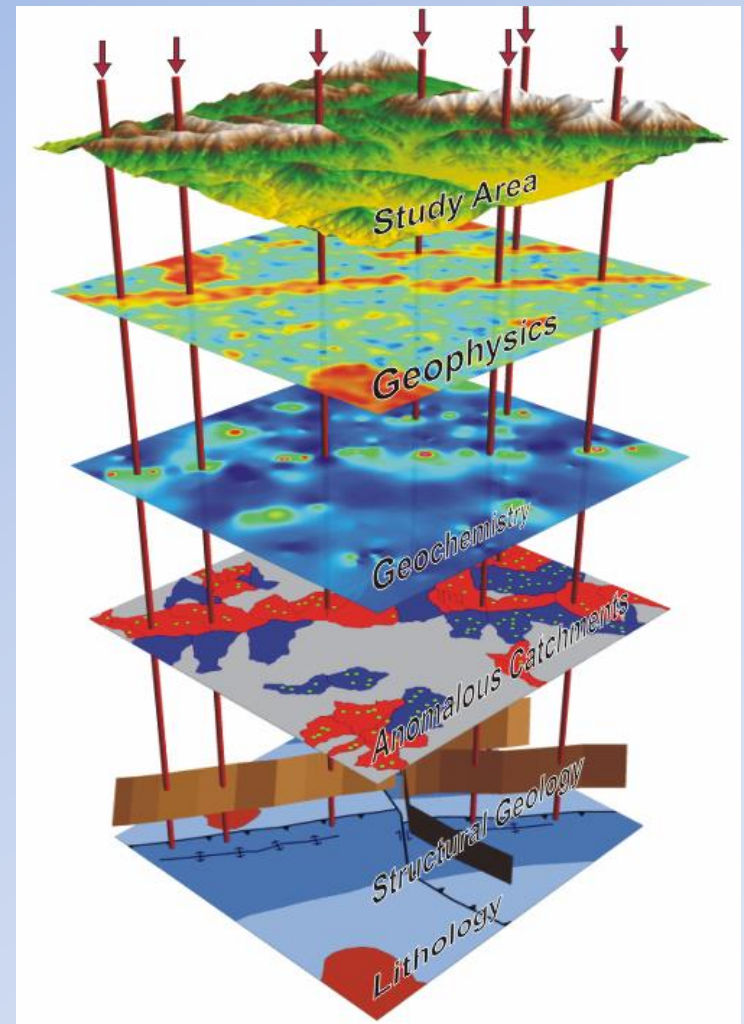
Fluid Flow and  
Metal Transport  
Mapping.

# New Tools Available To Apply Knowledge To Data



# Types of Modelling

Multi-variable Models: Fuzzy Logic, Neural Networks, and Weights of Evidence Predictive Modelling Replicating Known Systems

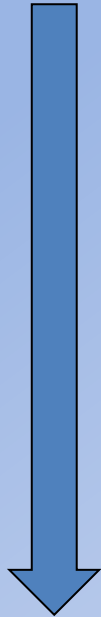
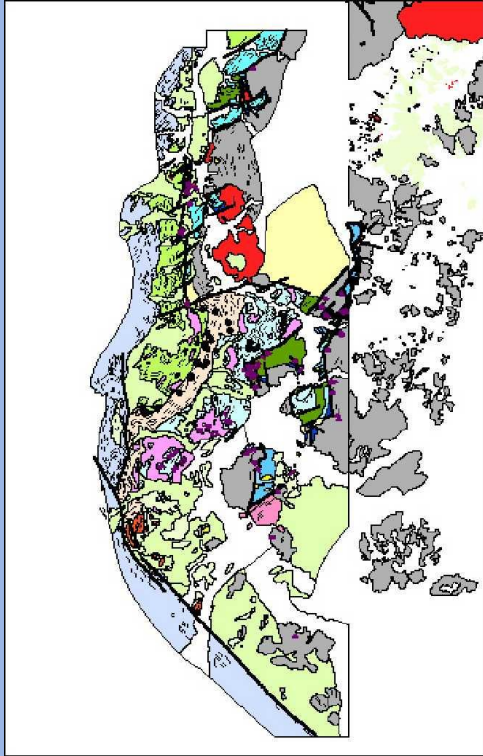


# How to Improve Your Chances of Success?



**The Practical Implication Of High Discovery Risk For Strategic Planning & Exploration Budgeting Is A Large Difference Between The Average Cost Of Exploration Success And The Level Of Funding Required To Ensure Success (e.g. - “World Class” Deposits)**  
*Discoveries Are Typically Made By The 5th-7th Person/Company Covering The Ground*

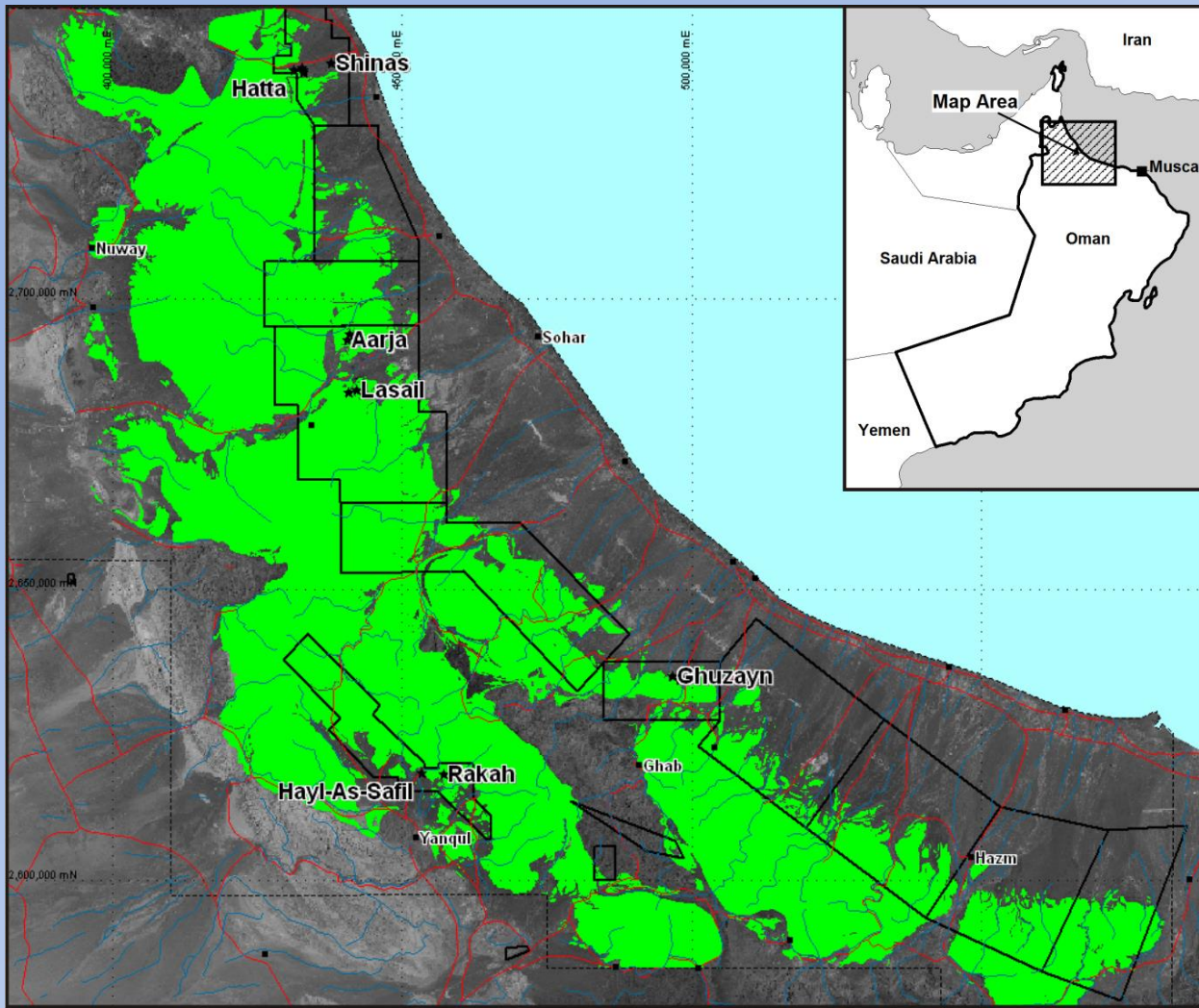
# Key to Targeting



- Requirement to Get from Regional to Prospect Scale Quickly and Cheaply.
- Scale Dependent.
- Mineral Exploration and Wind Energy are Similar.
- Need to Map Key Evidence for Locating Mineral Deposits or Wind Energy.

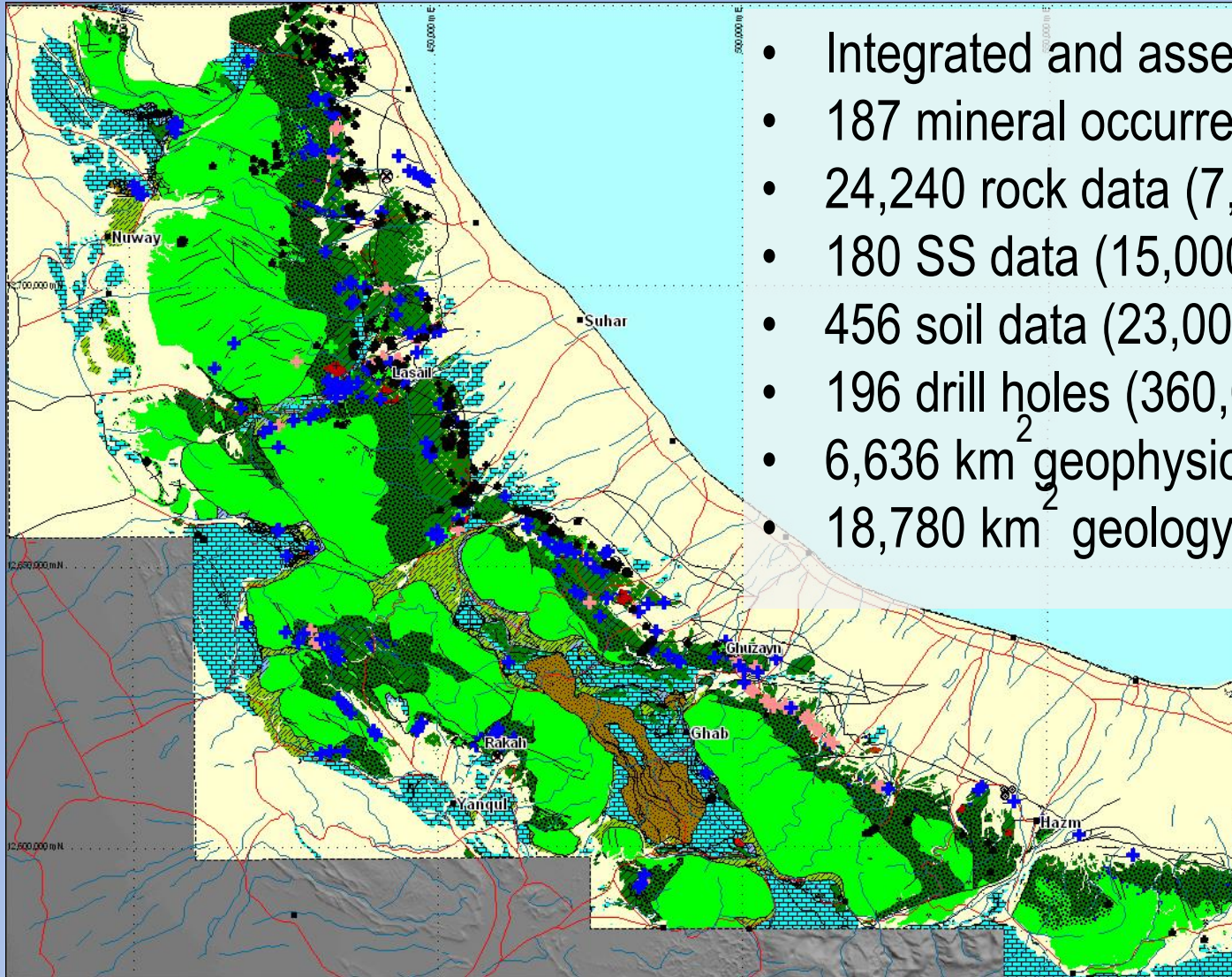


# Modelling VMS Cu-Au in Oman

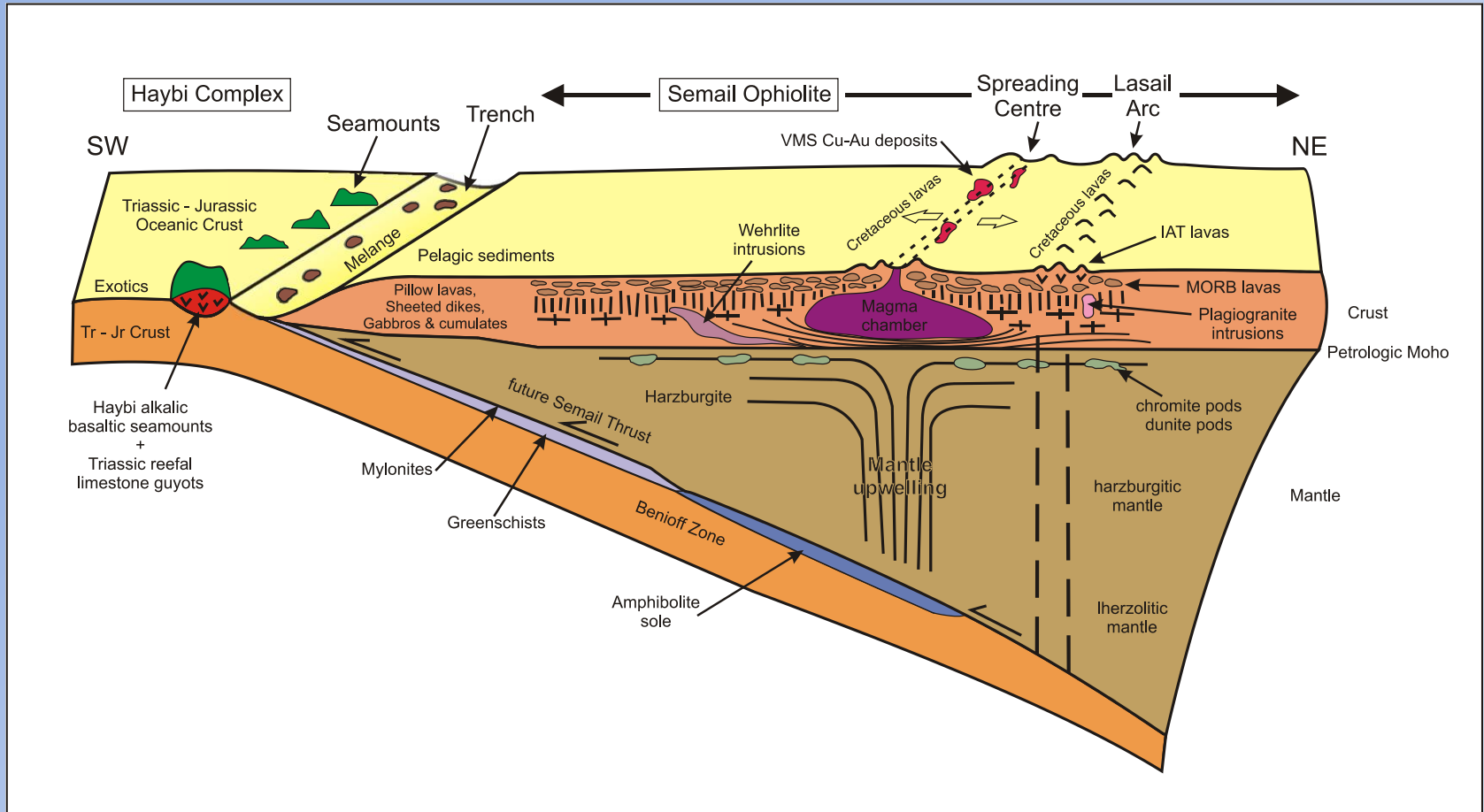


# Database That Covers Mineral System Area

- Integrated and assessed
- 187 mineral occurrences (240,000).
- 24,240 rock data (7,000,000).
- 180 SS data (15,000,000).
- 456 soil data (23,000,000).
- 196 drill holes (360,000).
- 6,636 km<sup>2</sup> geophysics (3,300,000 km<sup>2</sup>).
- 18,780 km<sup>2</sup> geology (11,000,000 km<sup>2</sup>).

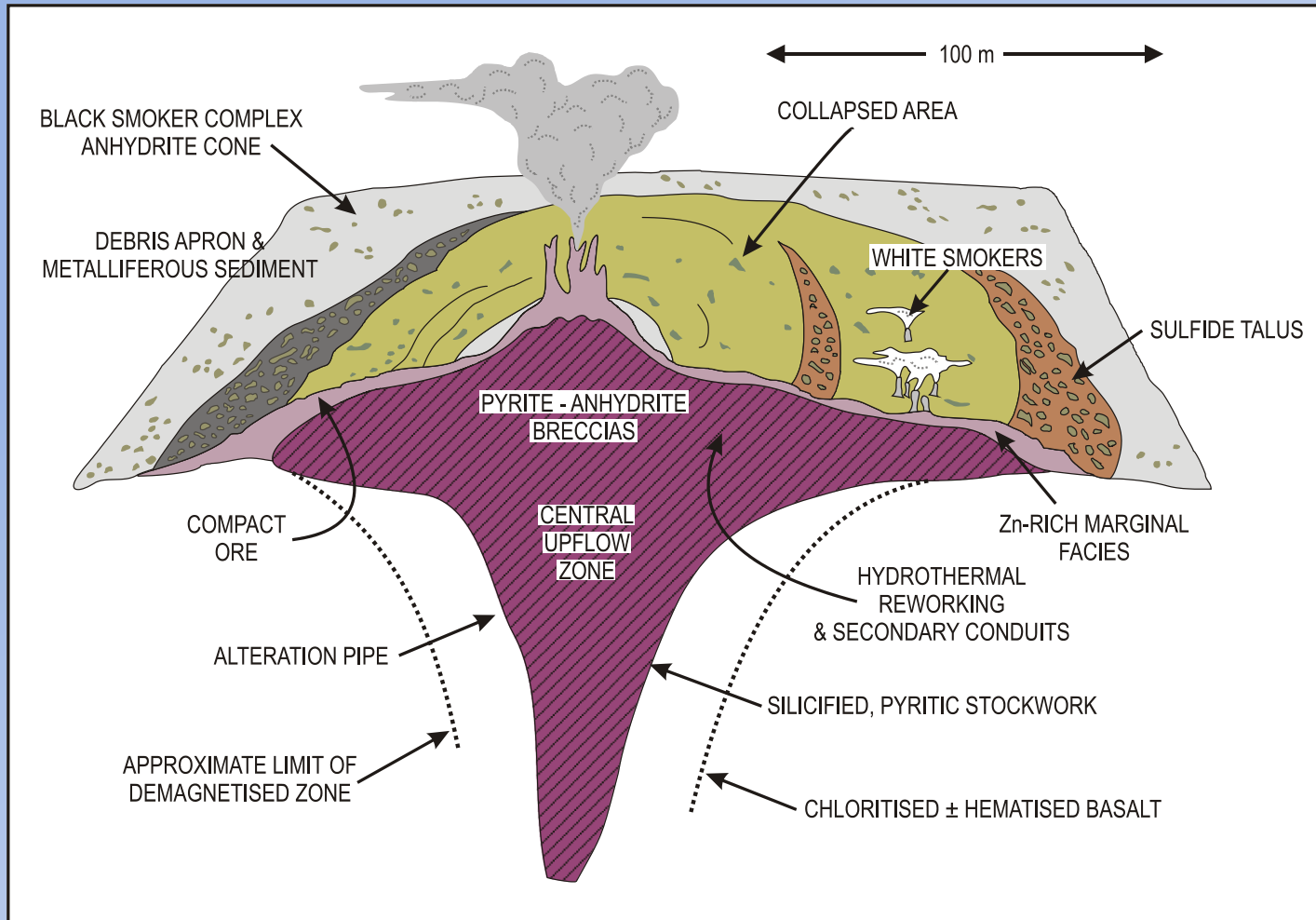


# Mineralisation In The Semail Ophiolite





# Troodos Style VMS Cu-Au Mineralisation

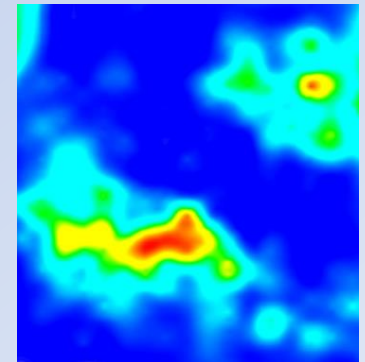
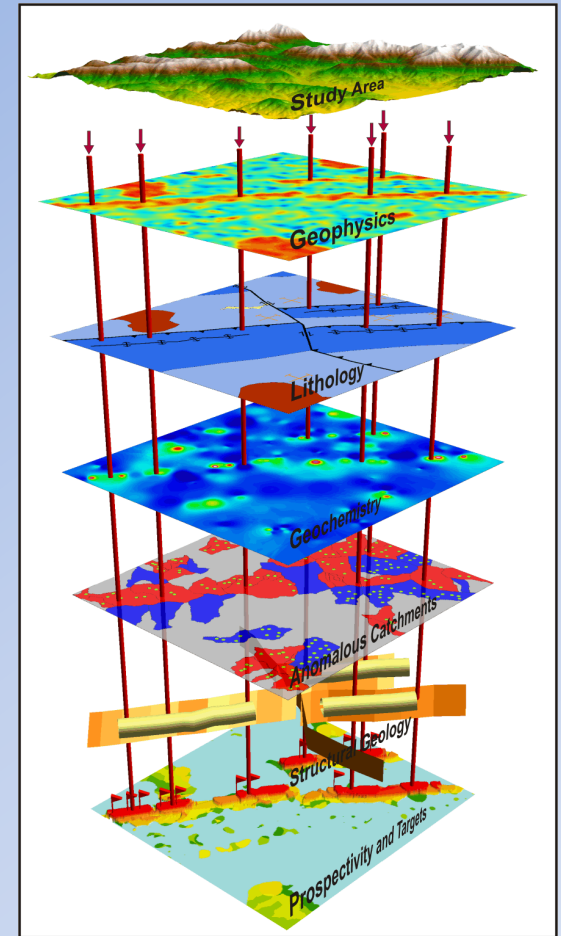


# Mineral Systems As A Guide To Predictive Maps

- Essential Geological Components Are:
  - Source of Energy that Drives the System.
  - Sources of Fluids, Metals and Ligands.
  - Pathways so Fluids Can Migrate to Trap Zones.
  - Trap Zones (i.e. narrow, effective pathways) in which Fluid is Focused and Fluid Composition is Modified to Allow Concentrated Deposition.
- Ore Deposit Formation is Precluded where a Particular Mineral System Lacks One or More of these Components.
- Need to Map Evidence for These Processes.

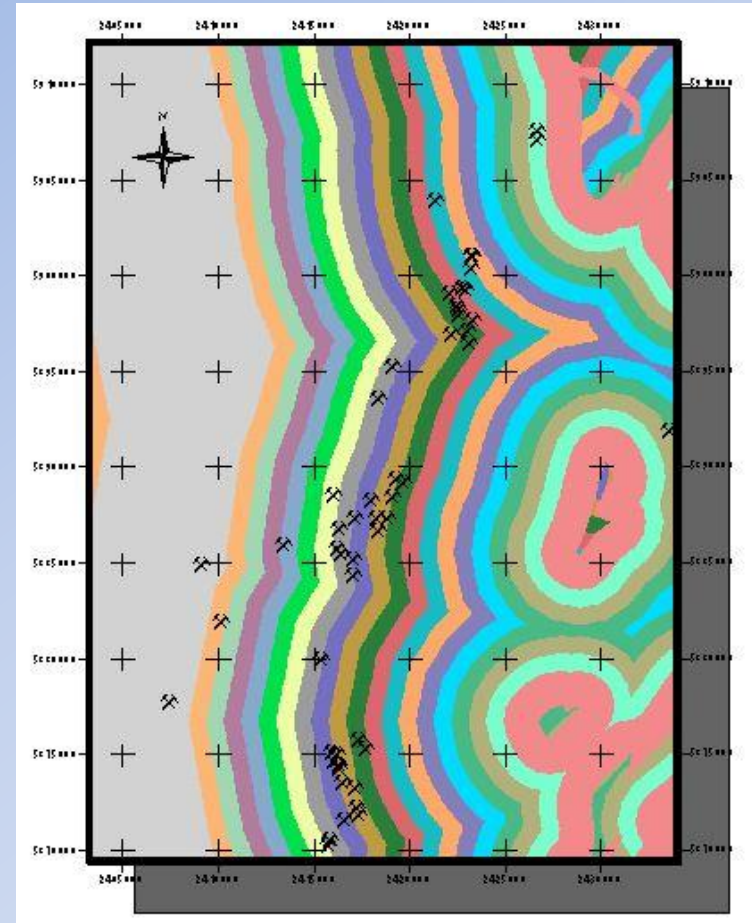
# WoE Modelling Approach

- Use All Digital Data Available
- Predictive Maps from Geological, Geochemical and Geophysical Data Based on Mineral System Model
- Use Known Deposits to Test Spatial Correlation of Maps
- Combine Maps Using Weights from Spatial Correlation
- Use Computer to Calculate Probability of an Occurrence for Each Grid Cell



# Predictive Maps

- Data That Map Key Processes in Mineral System
- Lithology
- Geochemistry.
- Structure.
- Rock Physics.
- Mineral Occurrences.

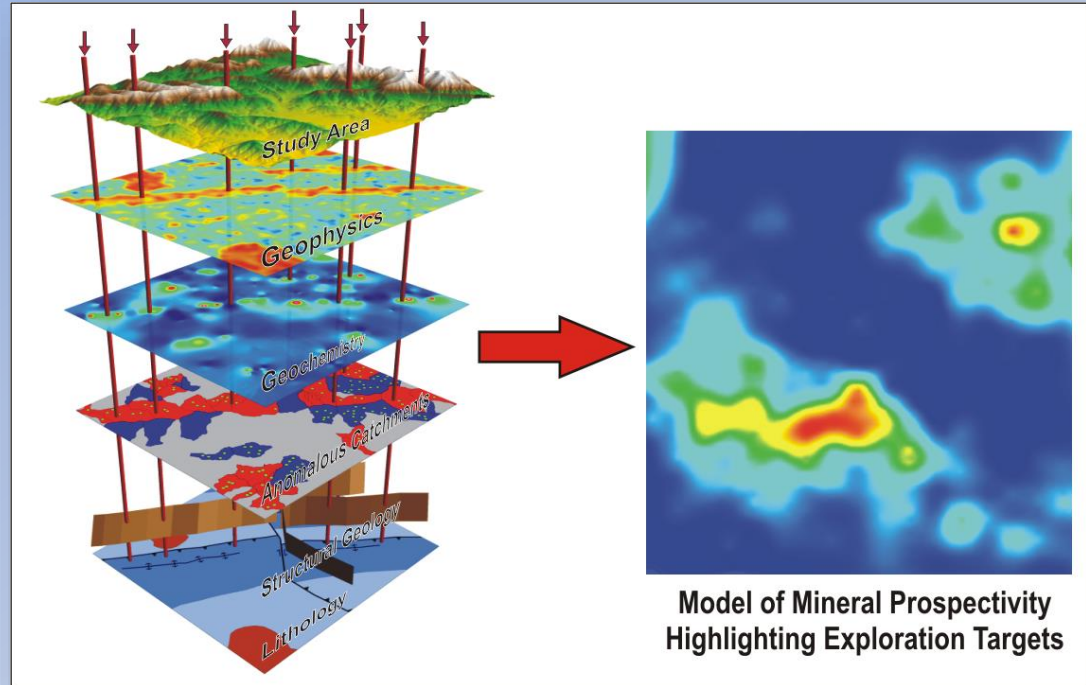


# Mineral System Model

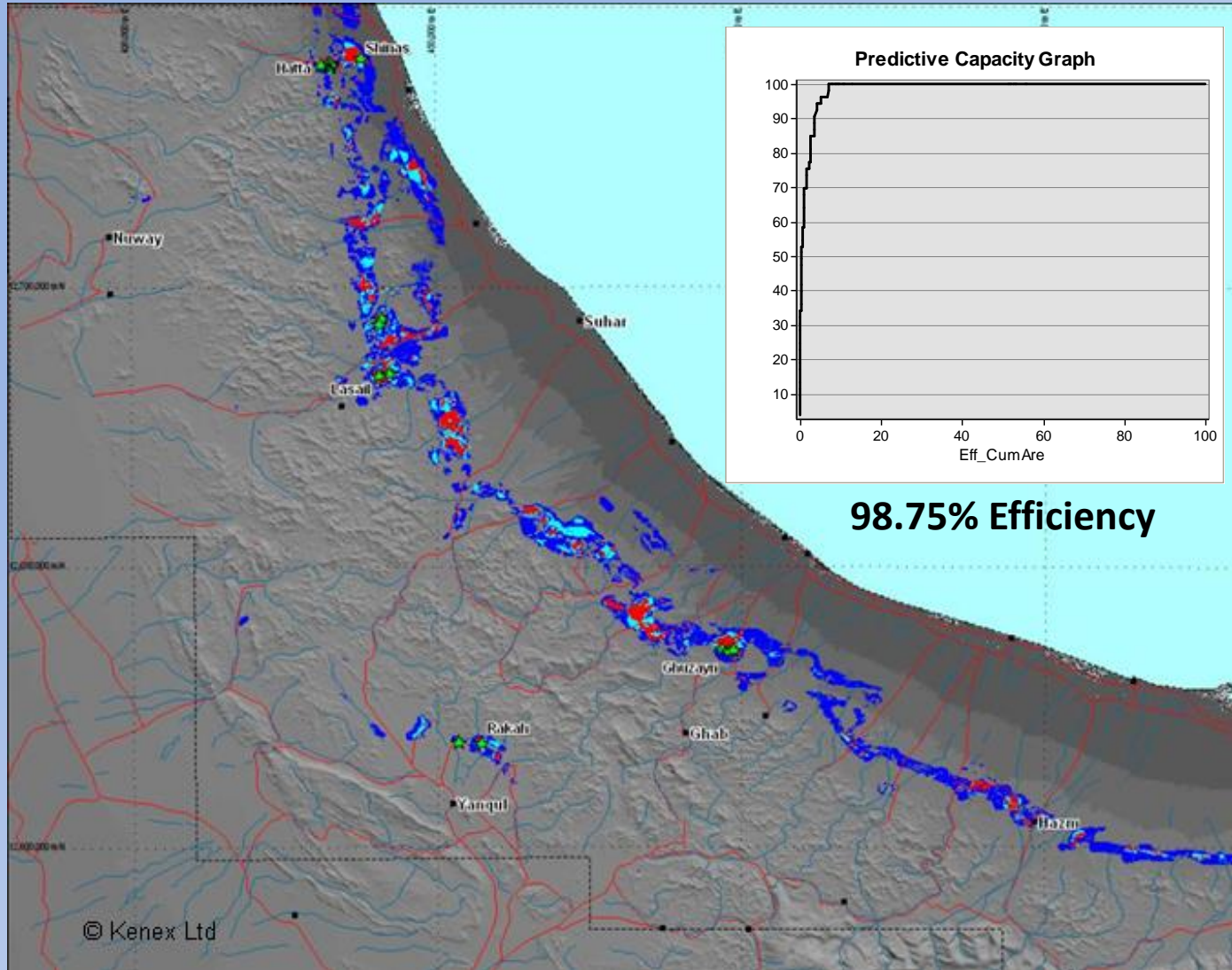
- Association with Basic to Intermediate Intrusions.
- Presence Gossans.
- Presence of Metalliferous Sediments.
- Presence of Syn Volcanic Faults.
- Relationship to Mineral Occurrence Clusters.
- Association with Magnetic Highs and Lows.
- Relationship to Fossil Seafloor.
- Presence of Anomalous Cu, Au, Pb, Zn, Mn, Fe, Ni or Co in Geochemical Samples.

# Model = Mineral System

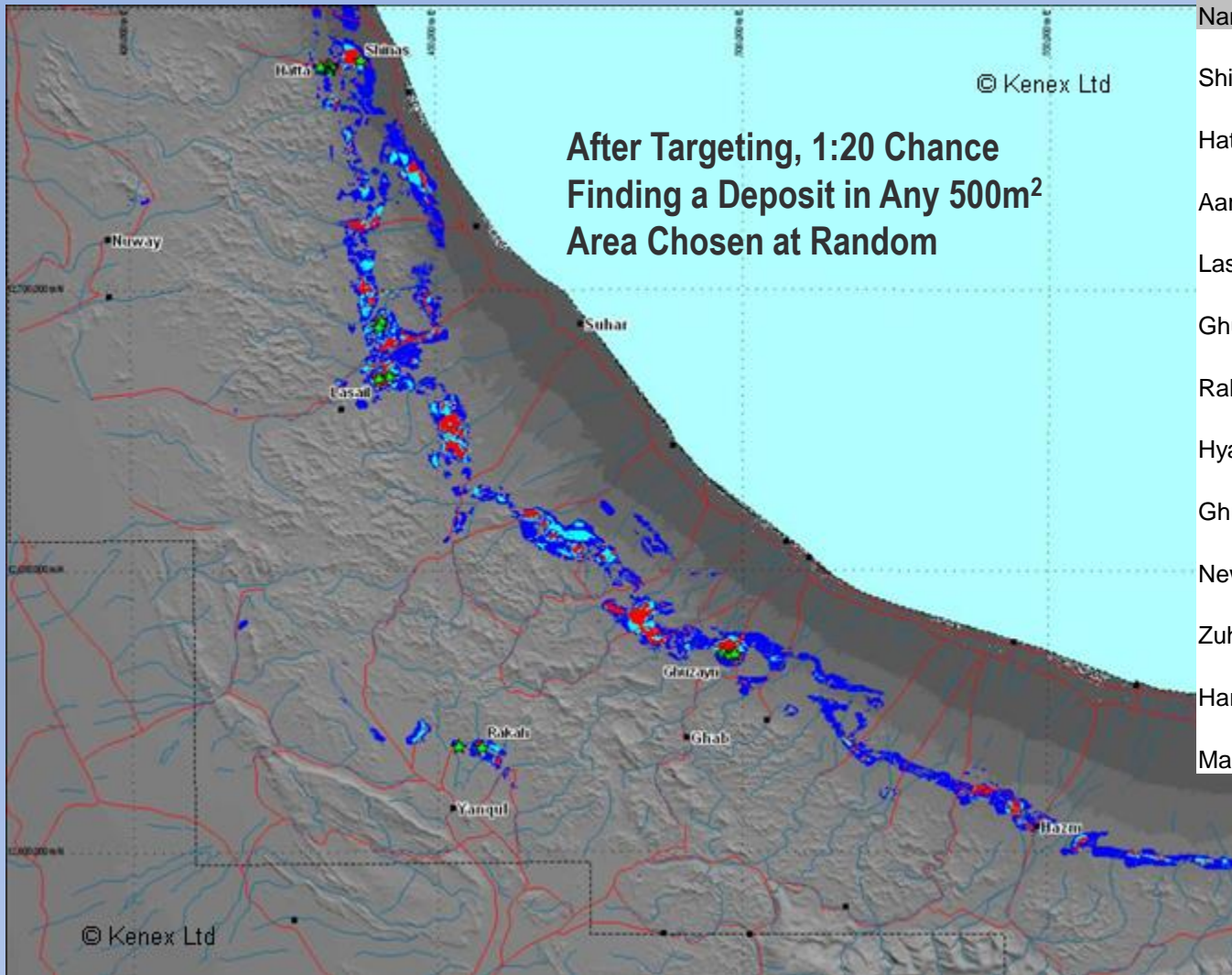
Map	Variable
VMS mineral occurrence clustering.	Source
Volcanic and syn volcanic lithologies.	Source
Syn volcanic faults.	Transport
Bends along syn volcanic faults.	Transport
Gossan out crops.	Trap
Lithological contacts that map the presence of the ancient seafloor.	Trap
Alteration mapped by magnetite destruction in volcanic lithologies.	Trap
Areas with anomalous copper values.	Deposition
Areas of high magnetic contrast.	Deposition



# Models Designed to Reduce Search Area



# Targets Identified Based on Known Examples



Name	Area	Tenement	PPb
Shinas	9.33	Block1	1.000
Hatta	4.57	Block1	1.000
Aarja	5.60	Block3	1.000
Lasail	17.48	Block4	1.000
Ghuzayn 3	21.11	Ghuzayn	1.000
Rakah	2.98	Block10	1.000
Hyal-as-Safil	0.30	Block10	0.550
Ghuzayn 2	21.11	Ghuzayn	1.000
New	1.34	Block1	0.995
Zuha	17.32	Block4	1.000
Hara Kilab	4.22	Block5	1.000
Mahab 3	1.06	Block5	0.998



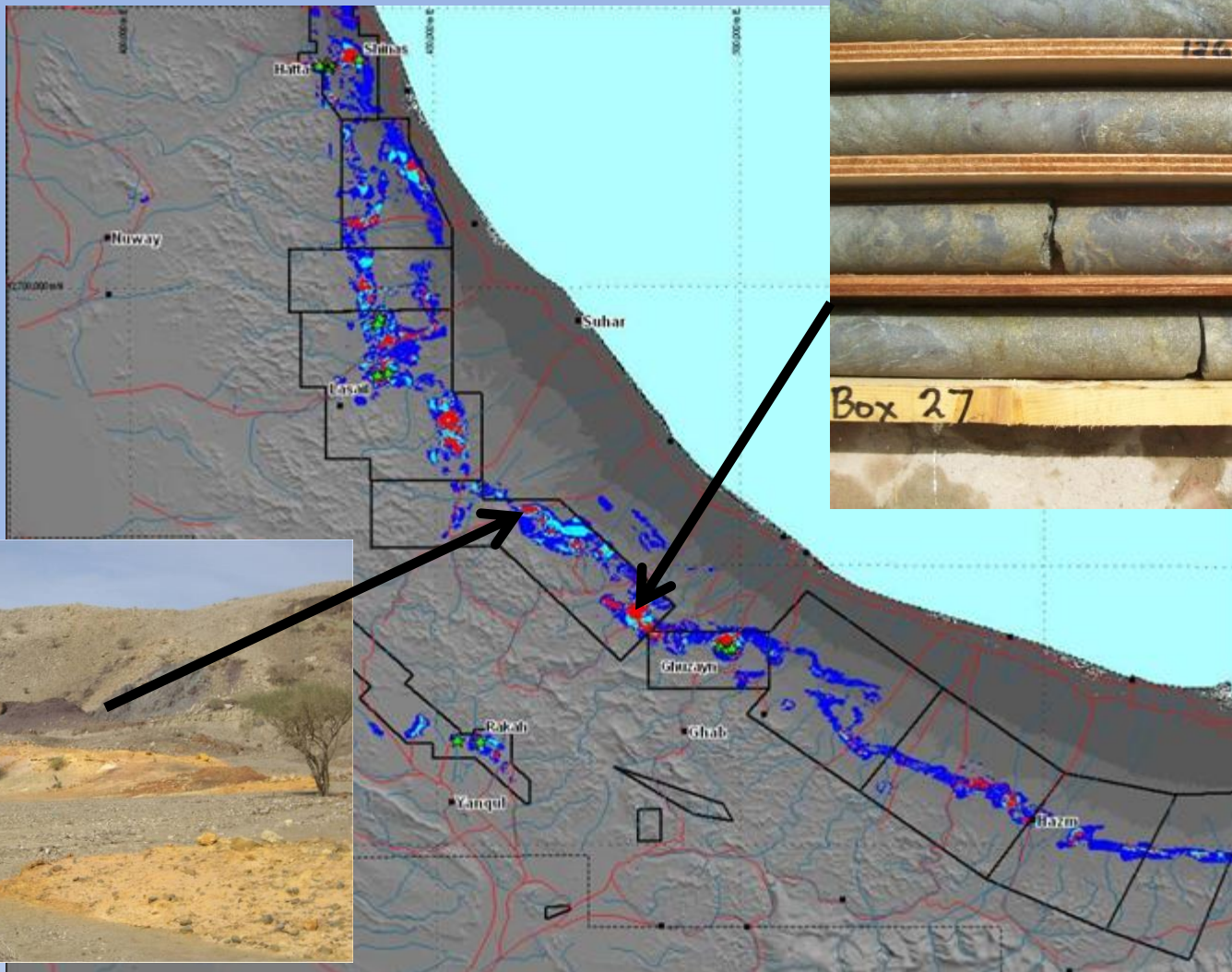
# Targets Ranked and Potential Defined

Name	Area	PPb	TPb	GPb	Uncertainty	Seafloor	VMSCluster	AnomCu	VolcAlteration	SynVolcRocks	Gossan	PlantDistance
Shinas	9.33	1.000	0.900	0.900	1.187	Present	Present	Missing	Present	Present	Missing	53
Hatta	4.57	1.000	0.900	0.900	1.125	Present	Present	Present	Present	Present	Absent	53
Aarja	5.60	1.000	0.900	0.900	1.022	Present	Present	Present	Absent	Present	Present	6
Lasail	17.48	1.000	0.900	0.900	1.255	Present	Absent	Missing	Present	Present	Absent	3
Ghuzayn 3	21.11	1.000	0.900	0.900	1.263	Present	Present	Missing	Present	Present	Missing	77
Rakah	2.98	1.000	0.900	0.900	1.120	Present	Present	Missing	Present	Absent	Present	71
Hyal-as-Safil	0.30	0.550	0.900	0.900	0.672	Absent	Present	Present	Present	Missing	Present	71
Ghuzayn 2	21.11	1.000	0.900	0.900	1.263	Present	Present	Missing	Present	Present	Missing	77
New	1.34	0.995	0.100	0.100	1.022	Absent	Present	Missing	Present	Present	Missing	52
Zuha	17.32	1.000	0.100	0.100	1.255	Absent	Present	Missing	Absent	Present	Present	17
Hara Kilab	4.22	1.000	0.700	0.500	1.263	Present	Present	Present	Present	Present	Present	37
Mahab 3	1.06	0.998	0.700	0.500	0.828	Present	Present	Present	Present	Present	Present	40
New	0.25	0.838	0.700	0.500	0.896	Present	Missing	Missing	Present	Present	Missing	57
Listwoenite	28.06	1.000	0.700	0.500	1.255	Present	Missing	Missing	Present	Present	Missing	64
New	0.69	0.999	0.700	0.500	1.305	Present	Missing	Missing	Present	Missing	Missing	72
Wadi Fayd	2.70	1.000	0.700	0.500	1.188	Present	Absent	Missing	Present	Present	Present	46
New	0.38	0.838	0.700	0.500	0.896	Present	Missing	Missing	Present	Present	Missing	40
New	0.41	0.838	0.700	0.500	0.896	Present	Missing	Missing	Present	Present	Missing	39

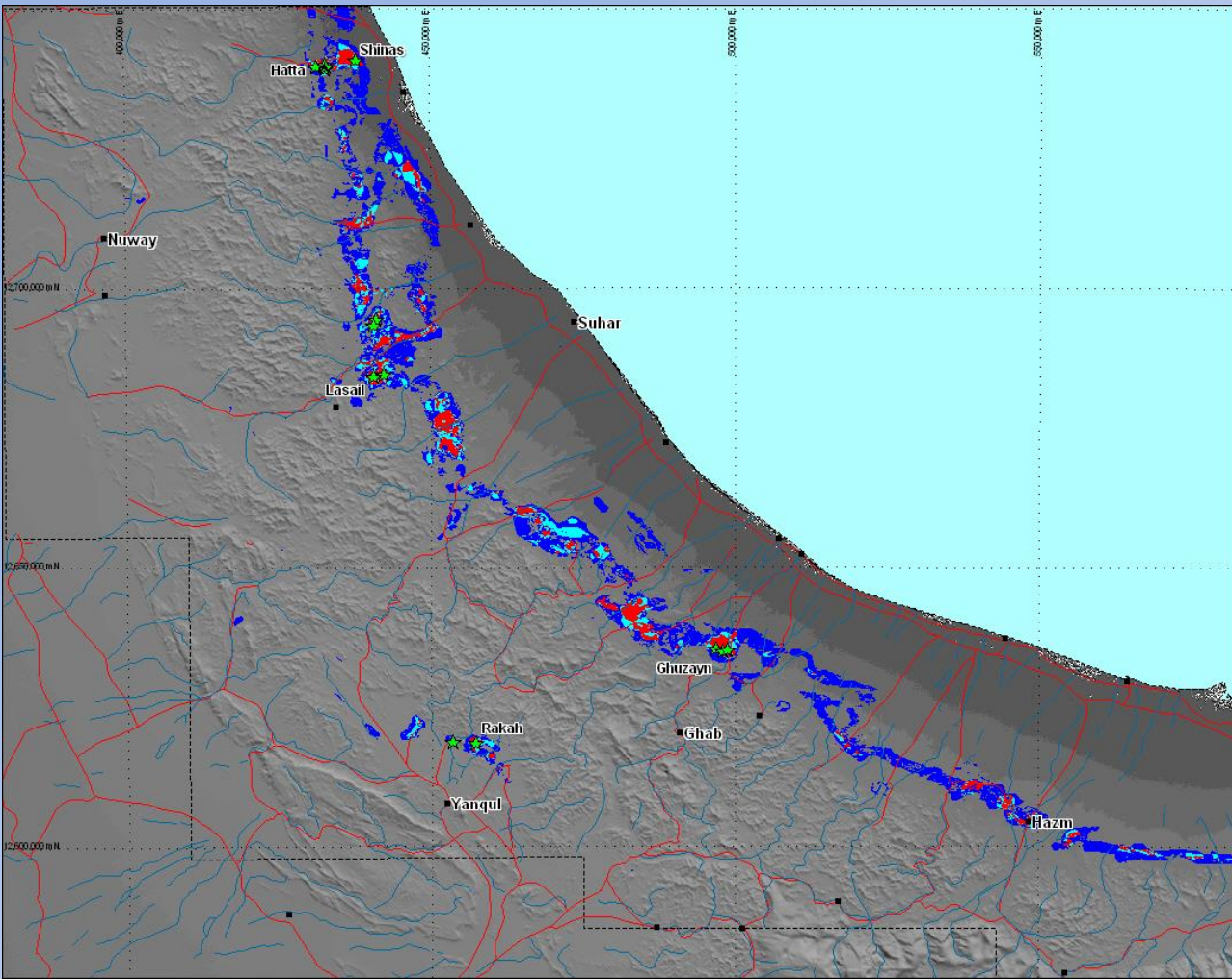
# Targeting Outcomes

- The spatial analysis highlighted the importance of geology, geochemical and alteration maps as predictors of mineralisation, with alteration, geology and structure particularly important.
- The prospectivity model identified 79 targets above the upper threshold in the study area. Nine of the targets are historic mines or current operations and seventy of the targets are at the prospect level of exploration.
- The targets in the study area range in probability values from the first ranked at 1.0 to 0.55, with 70 of the 79 targets having similar probability values to the main mines. Twenty of the targets are historic mineral occurrences or mines and the remaining fifty nine targets are new targets for exploration.

# Modelling Results and Outcomes



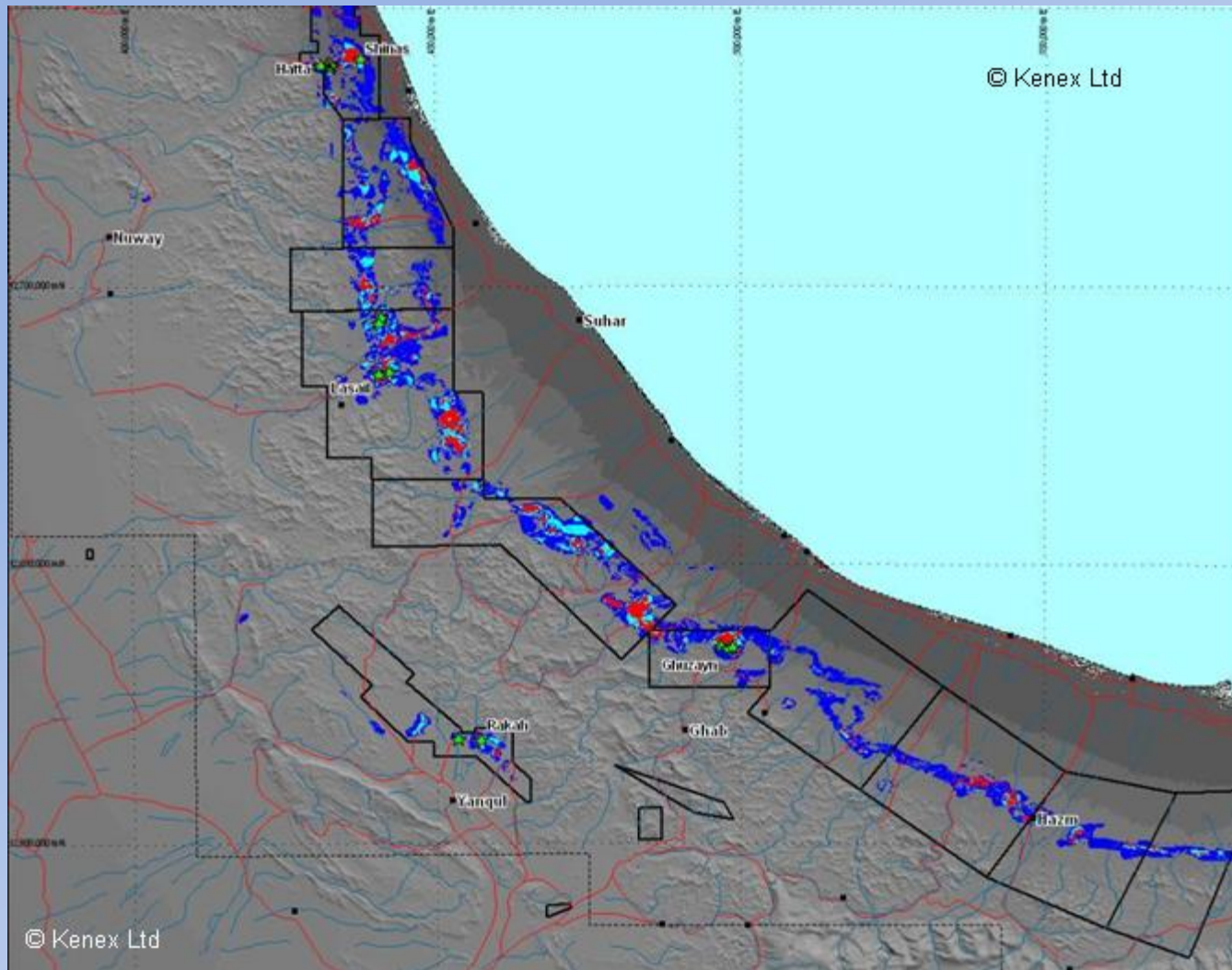
# What You Can Do With the Pmap Models



# Predictive Maps Correlated And Ranked

Map	System Variable	W+	W-
Gossan out crops.	Trap	4.30	-1.93
VMS mineral occurrence clustering.	Source	3.48	-2.61
Bends along syn volcanic faults.	Transport	2.84	-1.49
Lithological contacts that map the presence of the ancient seafloor.	Trap	2.63	-1.48
Alteration mapped by magnetite destruction in volcanic lithologies.	Trap	2.75	-1.89
Areas with anomalous copper values.	Deposition	2.35	-0.97
Syn volcanic faults.	Transport	2.25	-1.85
Volcanic and syn volcanic lithologies.	Source	1.95	-2.42
Areas of high magnetic contrast.	Deposition	1.44	-0.70

# New Business Development



# New Data Acquisition

Name	Area	Tenement	PPb	TPb	GPb	Uncertainty	Seafloor	VMSCluster	AnomCu	VolcAlteration	SynVolcRocks	Gossan	PlantDistance
Shinas	9.33	Block1	1.000	0.900	0.900	1.187	Present	Present	Missing	Present	Present	Missing	53
Hatta	4.57	Block1	1.000	0.900	0.900	1.125	Present	Present	Present	Present	Present	Absent	53
Aarja	5.60	Block3	1.000	0.900	0.900	1.022	Present	Present	Present	Absent	Present	Present	6
Lasail	17.48	Block4	1.000	0.900	0.900	1.255	Present	Absent	Missing	Present	Present	Absent	3
Ghuzayn 3	21.11	Ghuzayn	1.000	0.900	0.900	1.263	Present	Present	Missing	Present	Present	Missing	77
Rakah	2.98	Block10	1.000	0.900	0.900	1.120	Present	Present	Missing	Present	Absent	Present	71
Hyal-as-Safil	0.30	Block10	0.550	0.900	0.900	0.672	Absent	Present	Present	Present	Missing	Present	71
Ghuzayn 2	21.11	Ghuzayn	1.000	0.900	0.900	1.263	Present	Present	Missing	Present	Present	Missing	77
New	1.34	Block1	0.995	0.100	0.100	1.022	Absent	Present	Missing	Present	Present	Missing	52
Zuha	17.32	Block4	1.000	0.100	0.100	1.255	Absent	Present	Missing	Absent	Present	Present	17
Hara Kilab	4.22	Block5	1.000	0.700	0.500	1.263	Present	Present	Present	Present	Present	Present	37
Mahab 3	1.06	Block5	0.998	0.700	0.500	0.828	Present	Present	Present	Present	Present	Present	40
New	0.25	Block5	0.838	0.700	0.500	0.896	Present	Missing	Missing	Present	Present	Missing	57
Listwoenite	28.06	Block5	1.000	0.700	0.500	1.255	Present	Missing	Missing	Present	Present	Missing	64
New	0.69	Block10	0.999	0.700	0.500	1.305	Present	Missing	Missing	Present	Missing	Missing	72
Wadi Fayd	2.70	Block1	1.000	0.700	0.500	1.188	Present	Absent	Missing	Present	Present	Present	46
New	0.38	Block2	0.838	0.700	0.500	0.896	Present	Missing	Missing	Present	Present	Missing	40
New	0.41	Block2	0.838	0.700	0.500	0.896	Present	Missing	Missing	Present	Present	Missing	39

# Exploration Work Planning

- Key Data and Exploration Model
- Which Data Contribute to The Model?
- Identify Areas of Missing Data
- Highlight Data that Will Add Value
- Prioritise Exploration

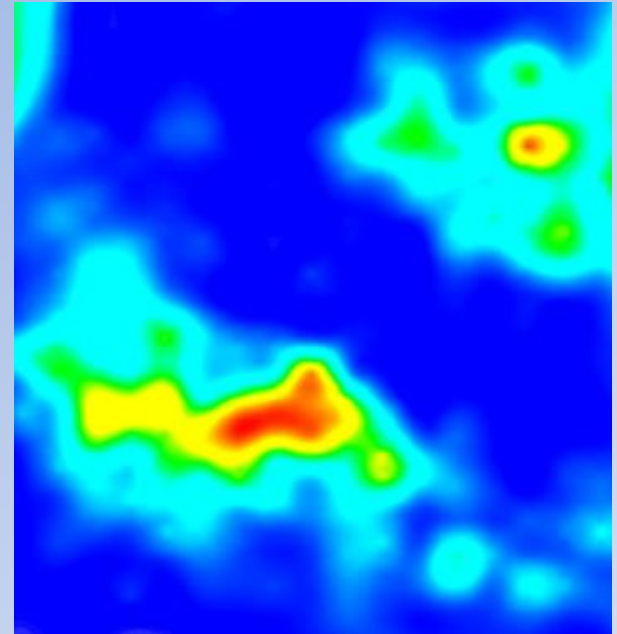


# Economic Assessments And What-if Scenarios

Name	Area	Tenement	Tonnes Likely	Cu %	Au g/t	Zn %	Mine Life	P(ore)	Margin	NPV	Exrisk	Chance Ex Risk	Chance NPV
Shinas	9.33	Block1	2,000,000	2.10	0.10	0.01	2	0.81	\$56	\$25	\$7	57.00%	74.90%
Hatta	4.57	Block1	1,500,000	3.50	1.00	0.60	1	0.81	\$147	\$118	\$82	99.98%	100.00%
Aarja	5.60	Block3/4	3,200,000	1.50	0.20	0.90	3	0.81	\$50	\$59	\$35	86.06%	94.02%
Ghuzayn 3	21.11	Ghuzayn	9,100,000	1.60	0.20	0.01	9	0.81	\$35	\$136	\$97	91.06%	93.90%
Bayda	5.60	Block3	1,000,000	3.10	1.20	1.40	1	0.81	\$151	\$65	\$39	97.60%	99.78%
Hyal-as-Safil	0.30	Block10	8,000,000	1.30	0.60	0.60	8	0.45	\$42	\$152	\$27	79.72%	98.30%
Ghuzayn 2	21.11	Ghuzayn	4,700,000	1.40	0.20	0.01	5	0.81	\$27	\$24	\$6	53.02%	66.10%
New	0.21	Block5	2,500,000	1.60	0.50	0.60	2	0.31	\$55	\$34	\$40	0.04%	82.50%
New	0.13	Open	2,500,000	1.60	0.50	0.60	2	0.30	\$55	\$34	\$41	0.00%	81.96%
New	0.47	Open	2,500,000	1.60	0.50	0.60	2	0.01	\$55	\$36	\$69	0.00%	84.42%
Hara Kilab	4.22	Block5	7,000,000	1.60	0.50	0.60	7	0.35	\$54	\$180	\$15	68.38%	99.58%
Mahab 3	1.06	Block5	2,500,000	1.60	0.50	0.60	2	0.35	\$54	\$33	\$37	0.28%	82.04%
Mahab 4	1.37	Block5	7,000,000	1.60	0.50	0.60	7	0.35	\$54	\$179	\$15	68.28%	99.42%
Mahab 2	1.40	Block5	7,000,000	1.60	0.50	0.60	7	0.35	\$54	\$178	\$14	66.18%	99.48%
New	0.83	Block5	2,500,000	1.60	0.50	0.60	2	0.01	\$54	\$35	\$70	0.00%	83.62%
New	0.25	Block5	2,500,000	1.60	0.50	0.60	2	0.33	\$54	\$35	\$35	0.16%	83.94%
New	1.15	Block5	2,500,000	1.60	0.50	0.60	2	0.35	\$54	\$35	\$34	0.62%	84.54%
New	0.25	Block5	2,500,000	1.60	0.50	0.60	2	0.29	\$53	\$31	\$43	0.00%	80.66%
New	4.93	Block5	7,000,000	1.60	0.50	0.60	7	0.35	\$53	\$179	\$17	69.48%	99.58%
Listwoenite	28.06	Block5	7,000,000	1.60	0.50	0.60	7	0.35	\$53	\$178	\$16	69.48%	99.50%

# Project Funding

- Raising Capital
- Marketing to Project Funders
- Highlighting Prospectivity
- Convincing Non Geologists
- Simplifying Complex Concepts of an Exploration Model
- Cost Reduction and Risk Minimisation



# Approach to Exploration Targeting

**Mineral Systems**

Critical processes

**Measure Prospectivity**

Geological risk

**Assess Cultural Issues**

Geopolitical risk

**Simulate Economic Value**

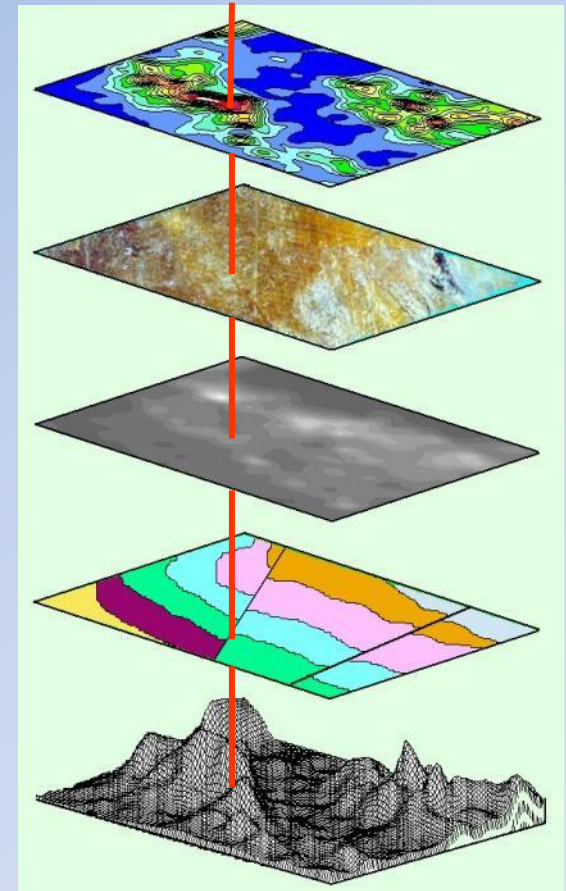
Financial risk

**Prospectivity Matrix**

Rank targets

# Exploration Investment Risk Minimisation

- You Can Measure Your Risks
- Data and Knowledge Can be Integrated
- You Can Make Sure You are Investing in the Opportunity that Gives the Best Chance of Success
- You Can Manage Your Exploration Investment More Effectively





# Kenex

Creating opportunities in the spatial world