Utilising technology to monitor and analyse mining operations in real-time

4th Biennial Conference

Presented by: Van Zyl Brink

Date: 10 October 2012


Tomorrow
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WHK
PLK
MFK
PTA
JHB
NEL
30%
KBY
BFN
60%
UP
Heavy rain
DBN
35
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EL
30
Dry
&
Windy
CTN
30%
PE
35
45


Connectedness
wisdom
knowledge
information
data
Understanding
Tomorrow
15
WHK
PLK
MFK
PTA
JHB
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Heavy rain
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Dry & Windy
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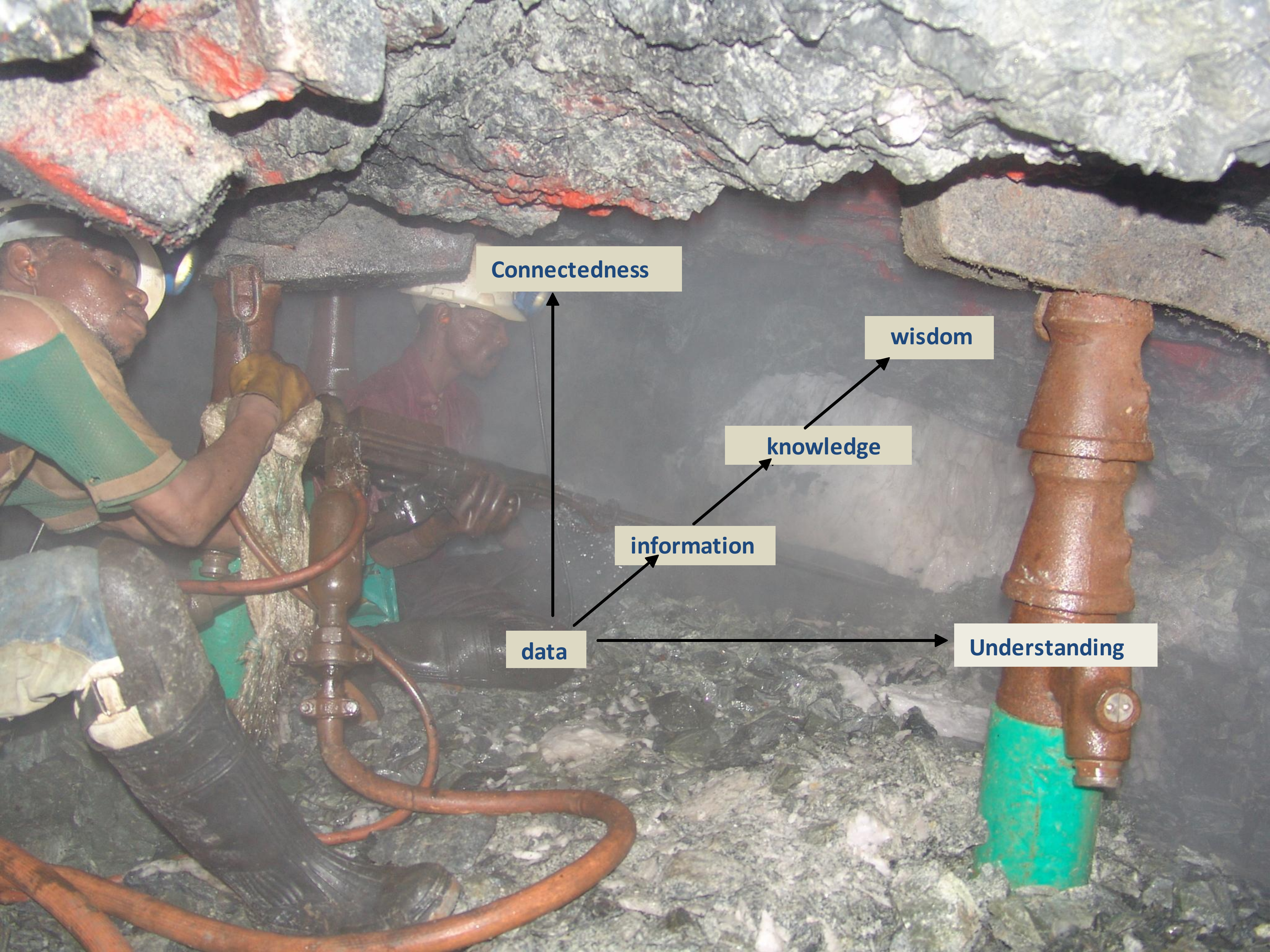
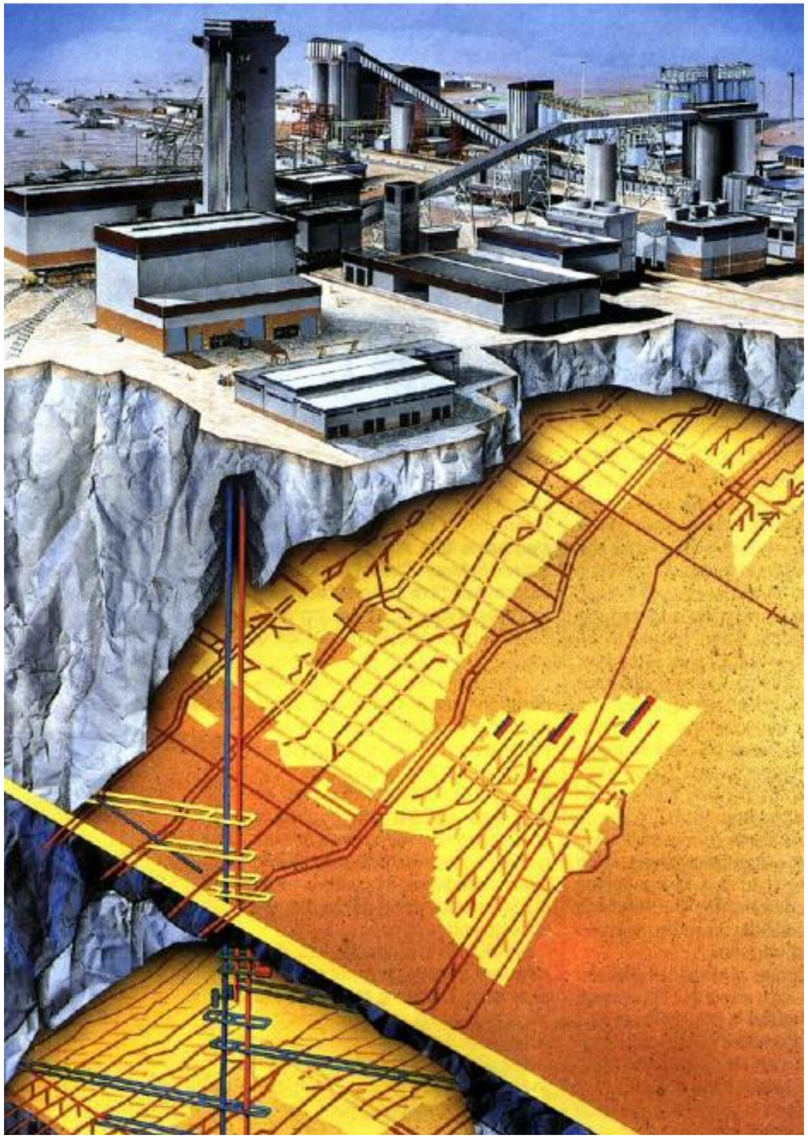

Connectedness
wisdom
knowledge
information
data
Understanding

It is a very sad thing that nowadays
there is so little useless information.

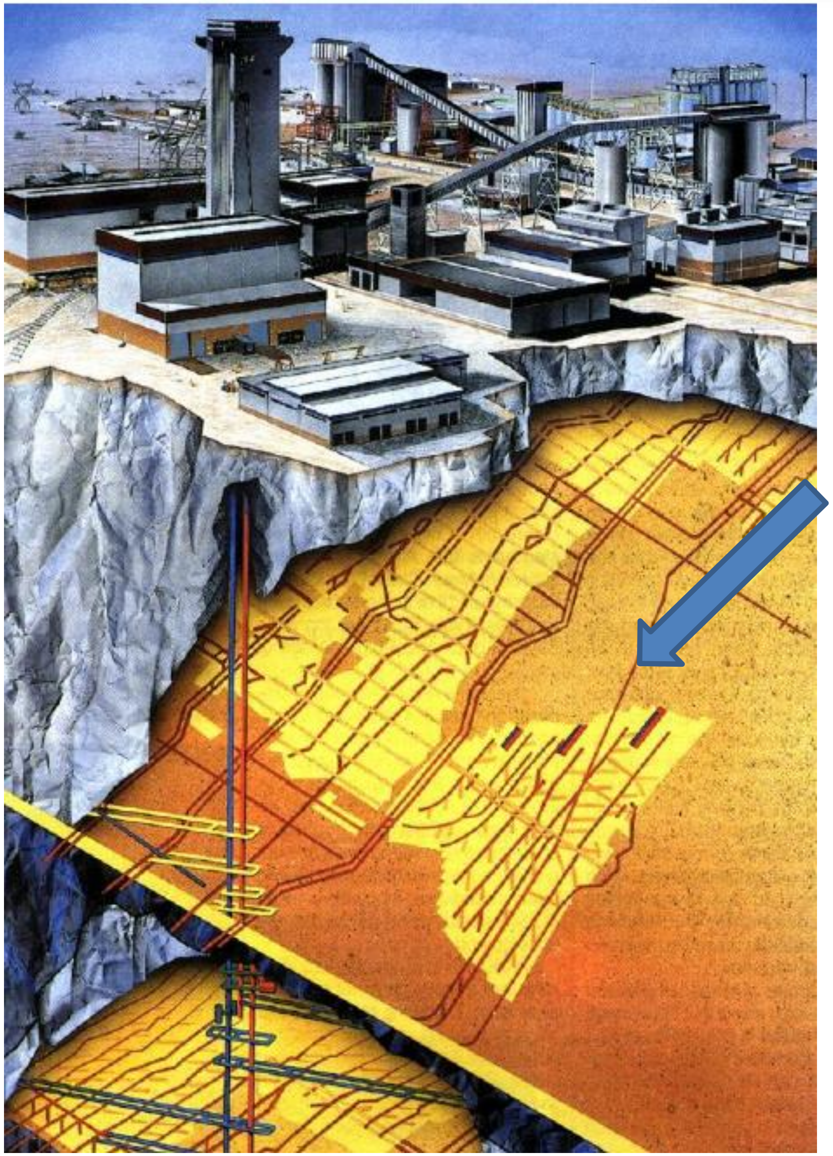
Oscar Wilde

What is AziSA?



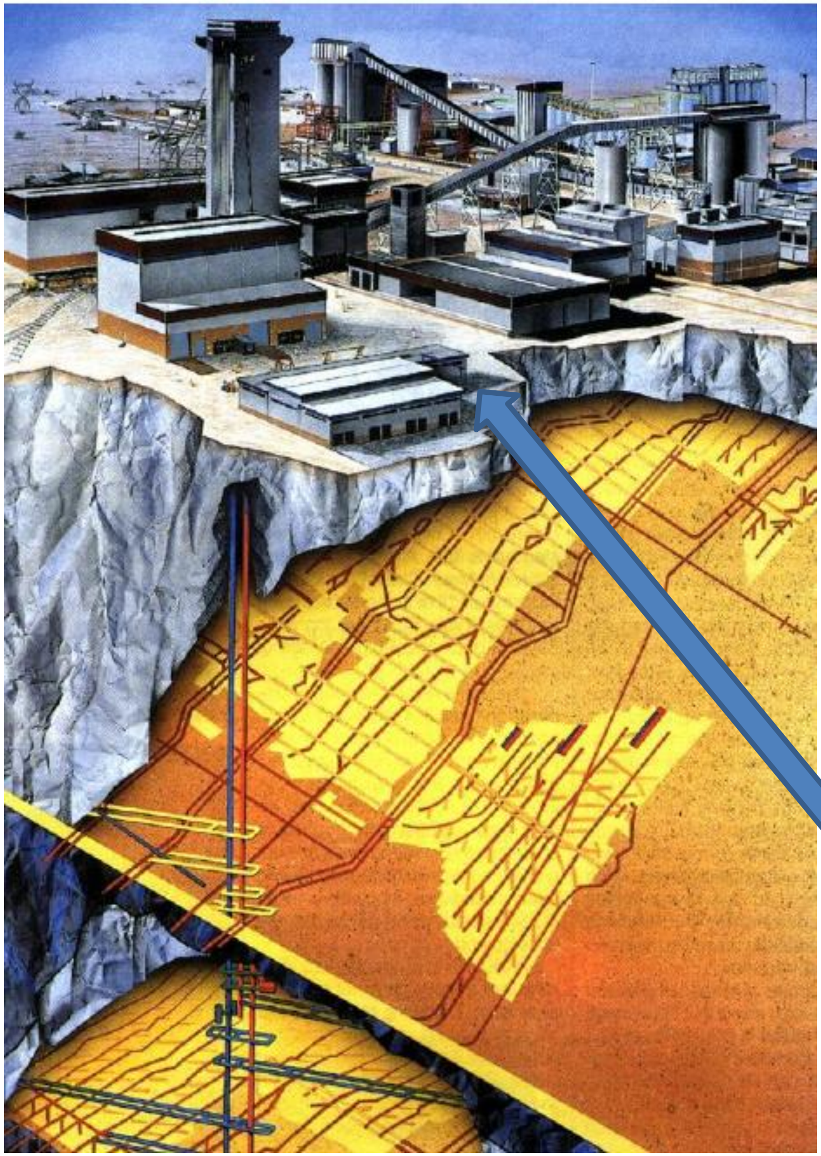
- A mine-wide network can centralise data capturing
- The infrastructure needed can provide *communication* channels to the working areas
- However, communication to the surface can be disrupted, so hazard identification and alarming should also take place *locally*
- This leads to a *distributed architecture* where sufficient automated decision-making is available at each working area

AziSA System Architecture



- Dumb sensors which are relatively cheap and disposable and must report their data over a wireless link
- Intelligent sensors which have local decision-making capability and data storage, which optionally communicate wirelessly
- A local wireless sensor network is managed by an *aggregator* which is a flexible mine-worthy computer that connects over a wired network to a central server.
- The server manages a central database and all connections to clients; it can make decisions based on mine-wide conditions

AziSA System Architecture



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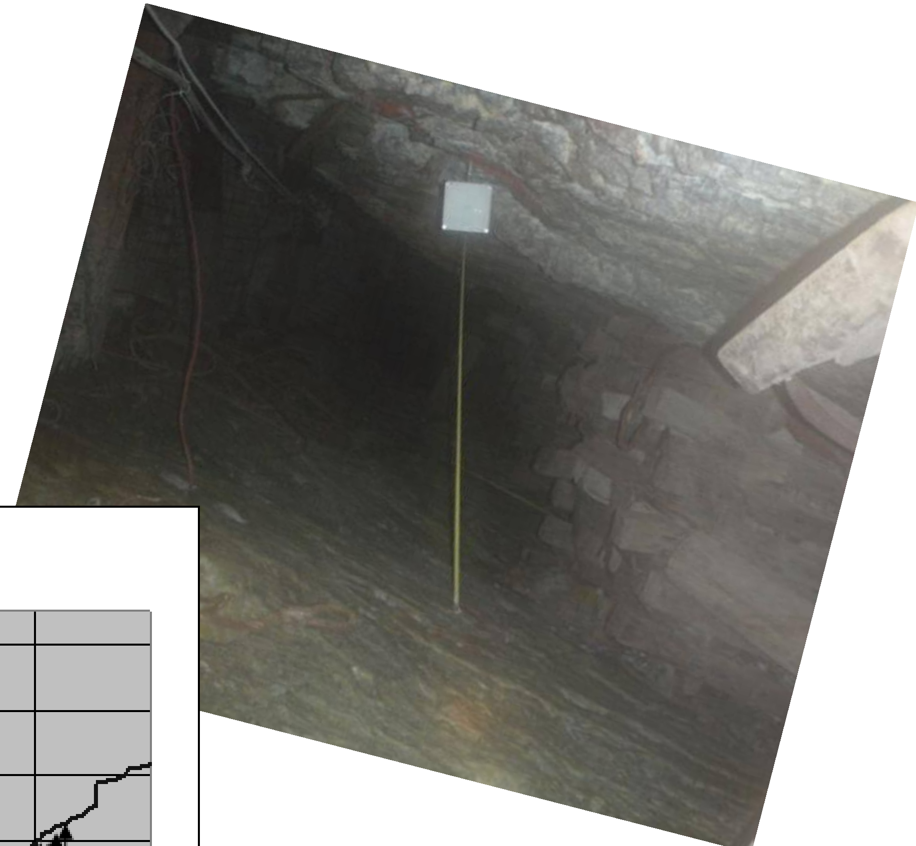
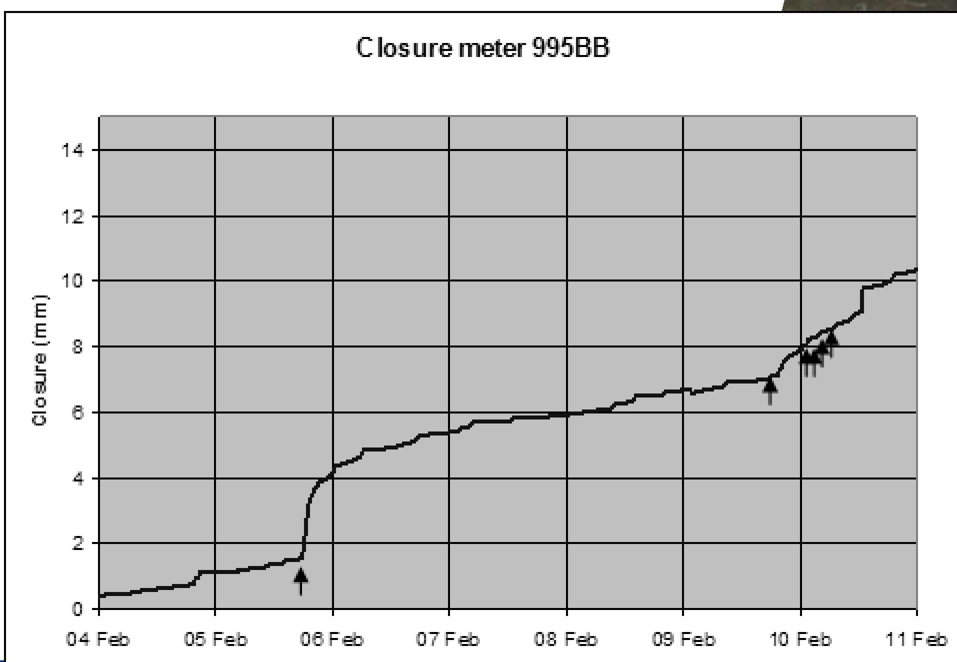
AziSA Class 4

The AziSA Class 4 is a dumb sensor which is relatively cheap and disposable and must report its data over a wireless link.





CSIR
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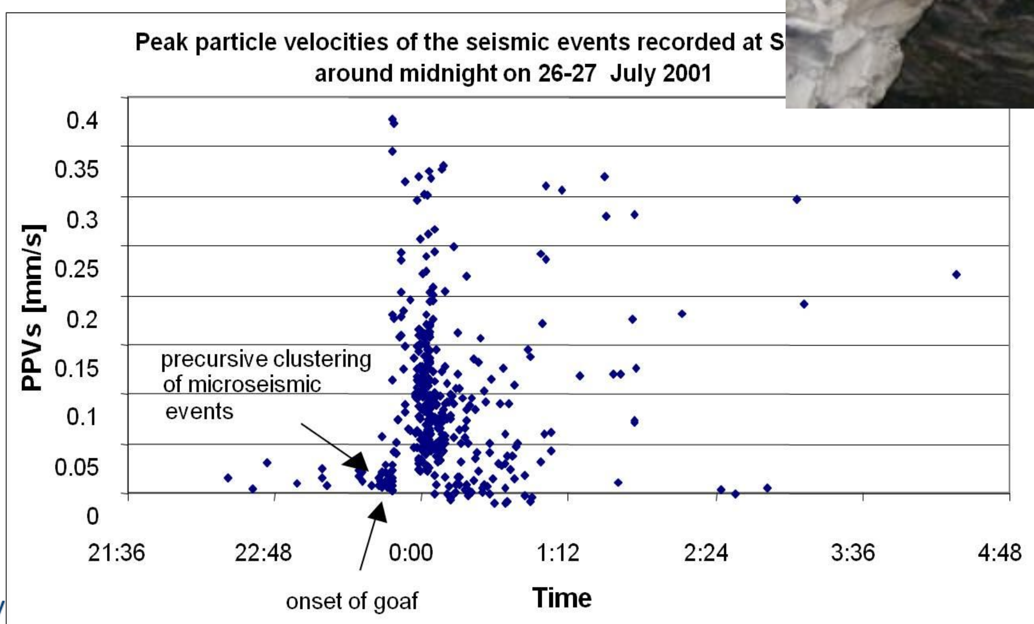
AziSA Class 3

The AziSA Class 3 is an intelligent sensor which has local decision-making capability and data storage, which optionally communicate wirelessly

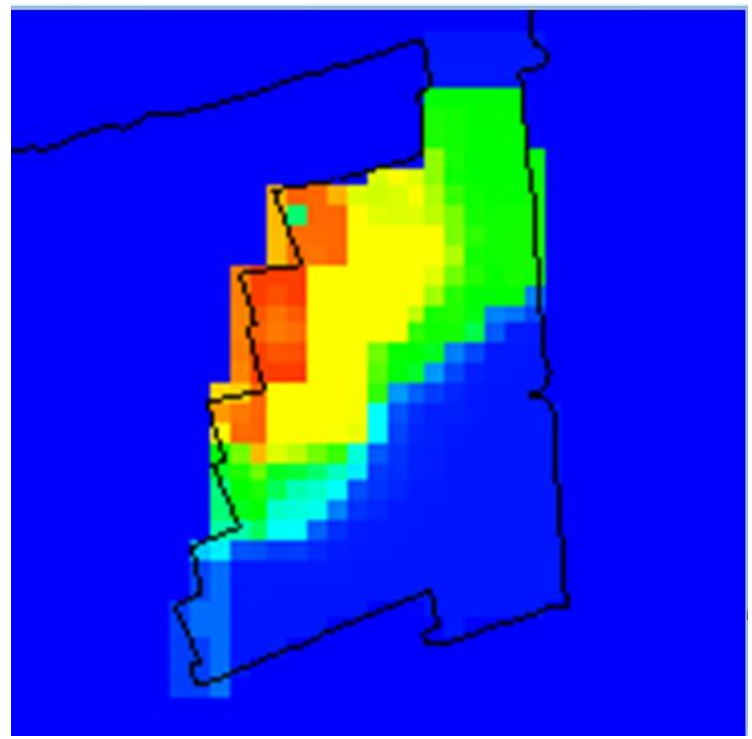


AziSA Class 2

- A local wireless sensor network is managed by an *aggregator* which is a flexible mine-worthy computer that connects over a wired network to a central server. It can make local decisions and issue local alarms

AziSA Class 1

- The server manages a central database and all connections to clients; it can make decisions based on mine-wide conditions



AziSA System Implications

- Reliable data means that the system must be *self-monitoring*
- Using arbitrary channels means that the hardware and software must flexibly handle multiple standards and protocols
- Sensor metadata must be available at point of *sensor commissioning*
- Multiple sources of data with heterogeneous types, including from human observation and existing SCADA systems
- Wide range of potential consumers means the server architecture must be *extensible*
- Preliminary risk assessments must be passed to relevant decision makers, or *directly* to area through visual/audio alarms.

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AziSA applications

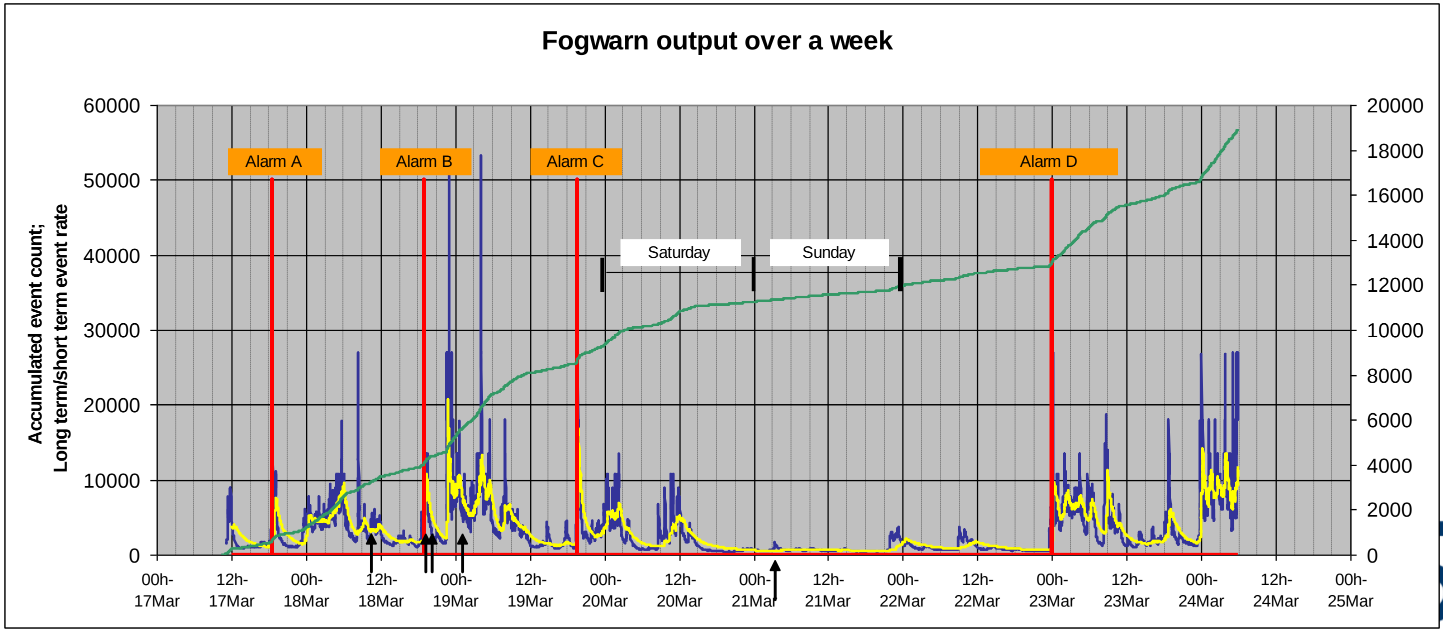
- Rockfall risk assessment in hard rock mines
- Early warning of goafing in coal
- Entry examination
- Gas sensing flammable gas in hard rock mines
- Continuous monitoring fragmentation monitoring for blast optimisation

AziSA applications

- **Rockfall risk assessment in hard rock mines**

Objective – Develop technology for continuously assessing the risk of rockfalls in mines.

Primary Partner: Mine Health and Safety Council
Industry support: Gold Fields of South Africa
Impala Platinum

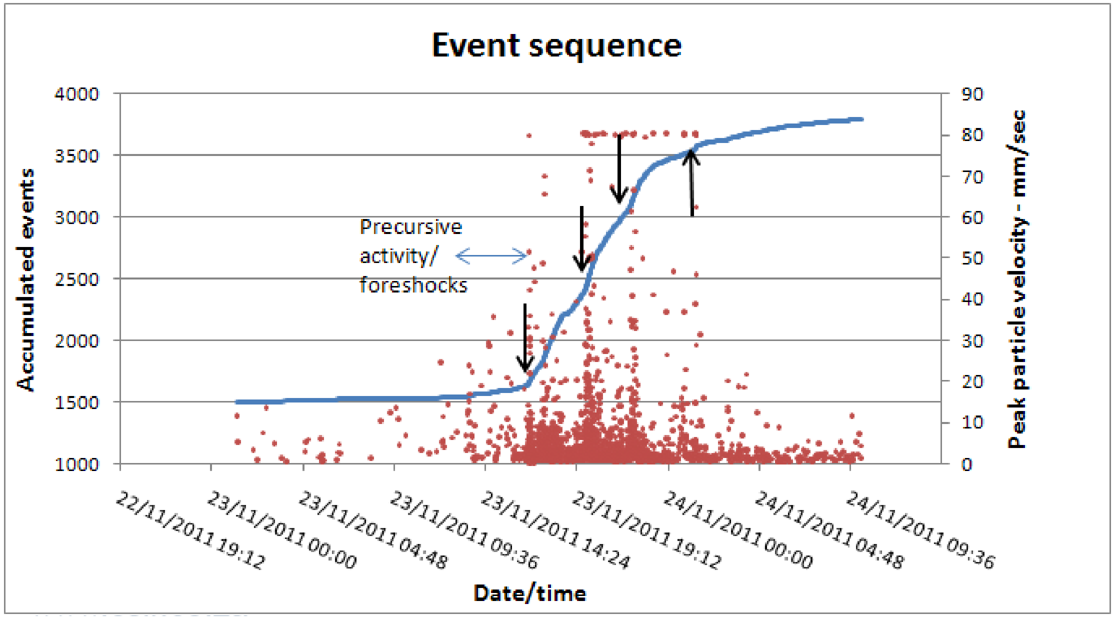


AziSA applications

- **Early warning of goafing in coal**

Objective – Apply AziSA to provide early of a pending large goafs in coal mines.

Industry support: New Denmark Mine (AngloCoal)
Xstrata Mining
Sasol Mining



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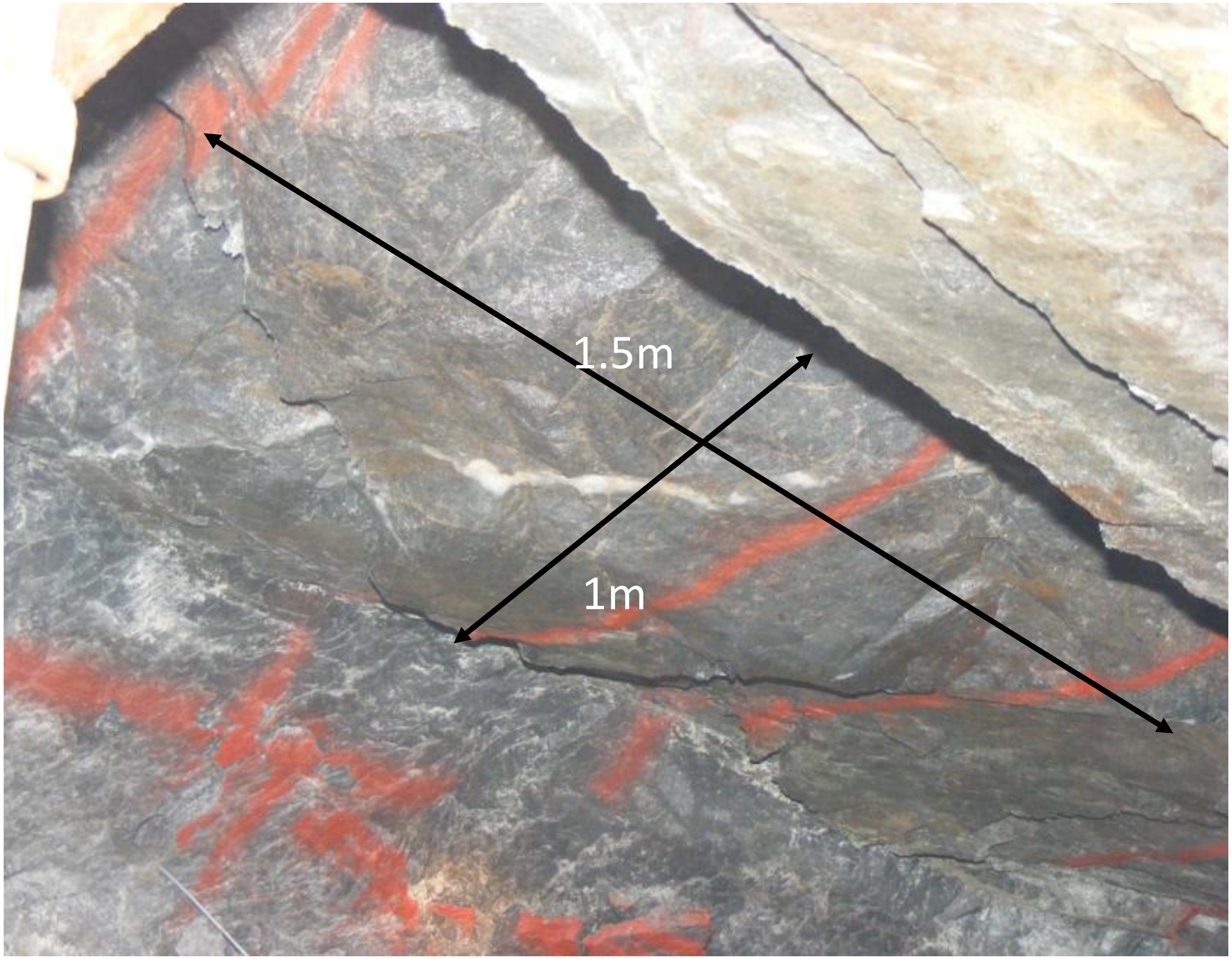
AziSA applications

- **Entry examination**

Objective – Provide technology to recognise unstable rock.

AziSA application - Entry examination



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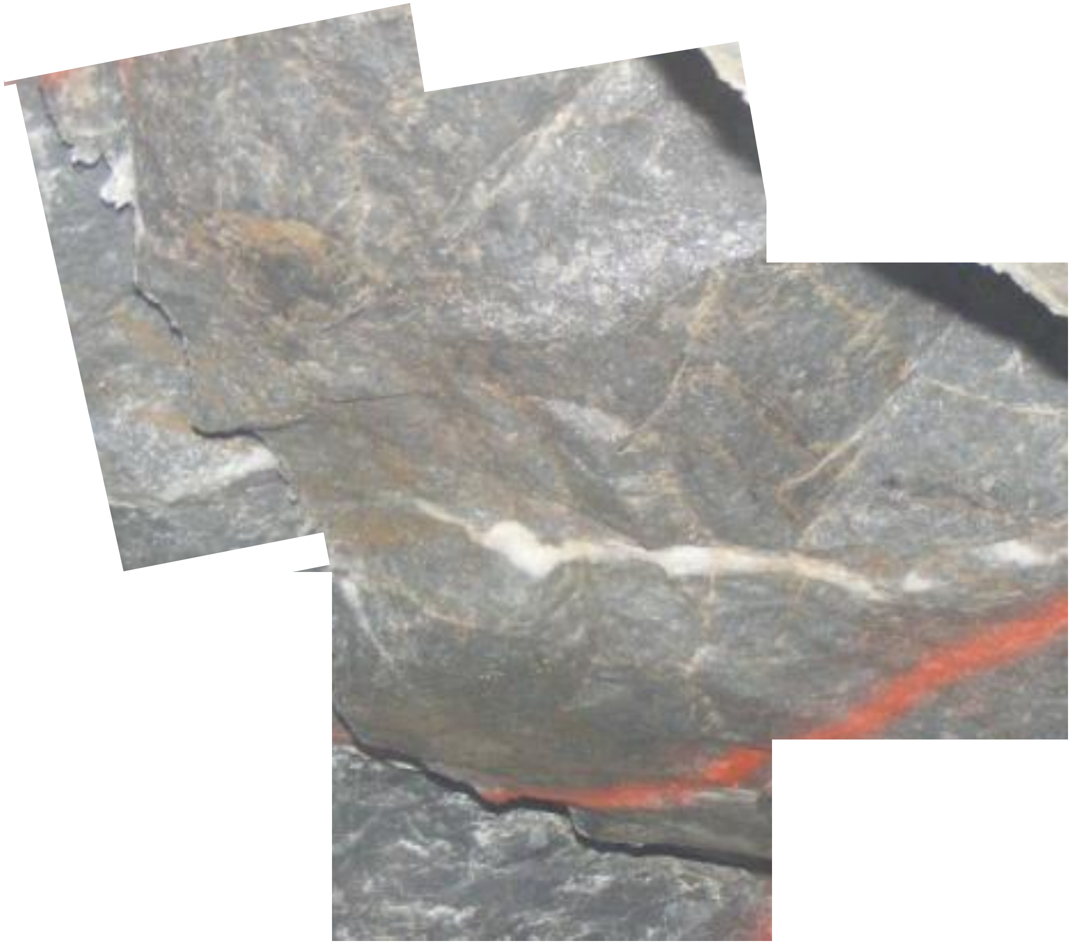

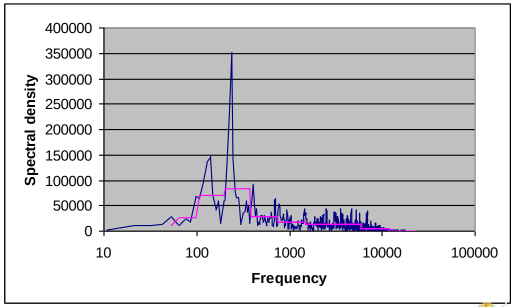
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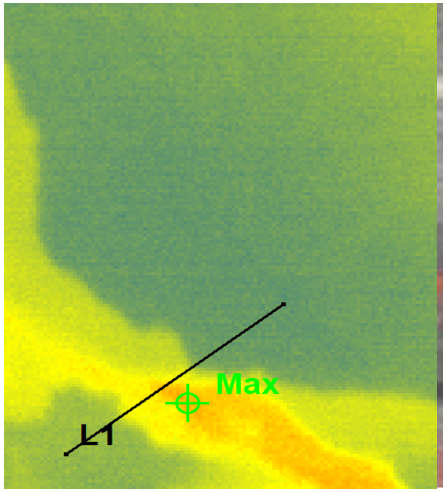
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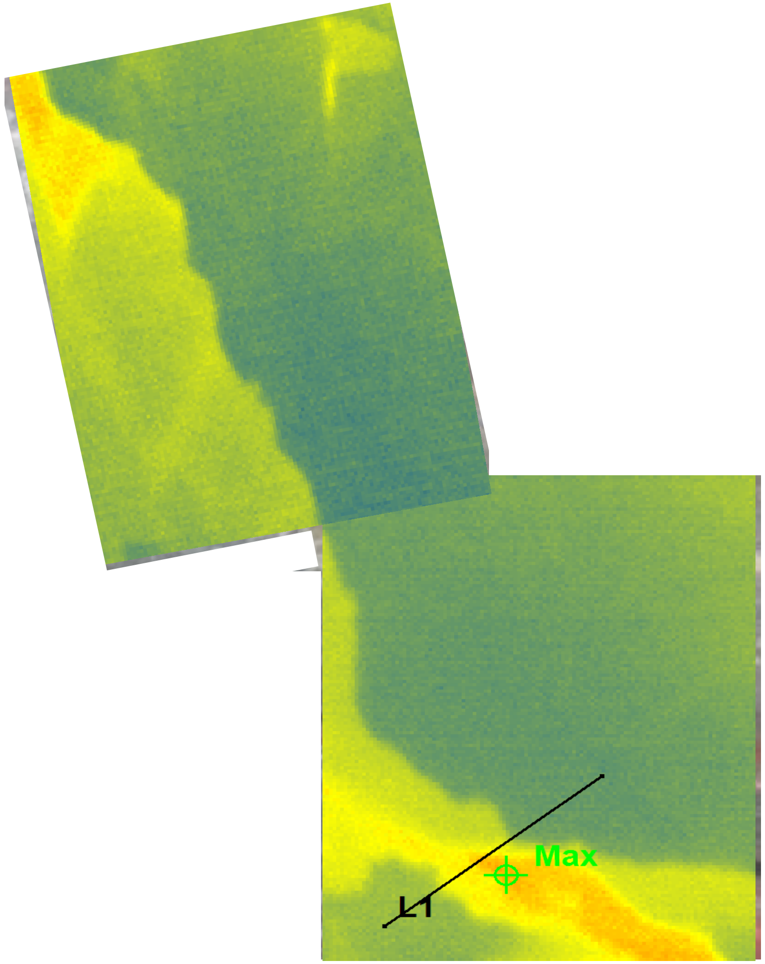

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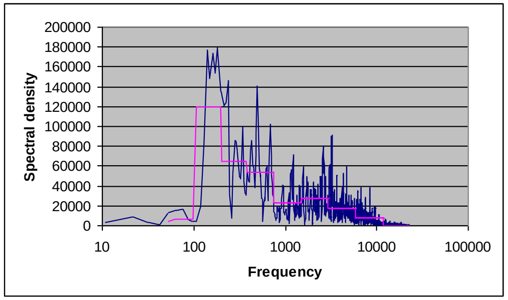

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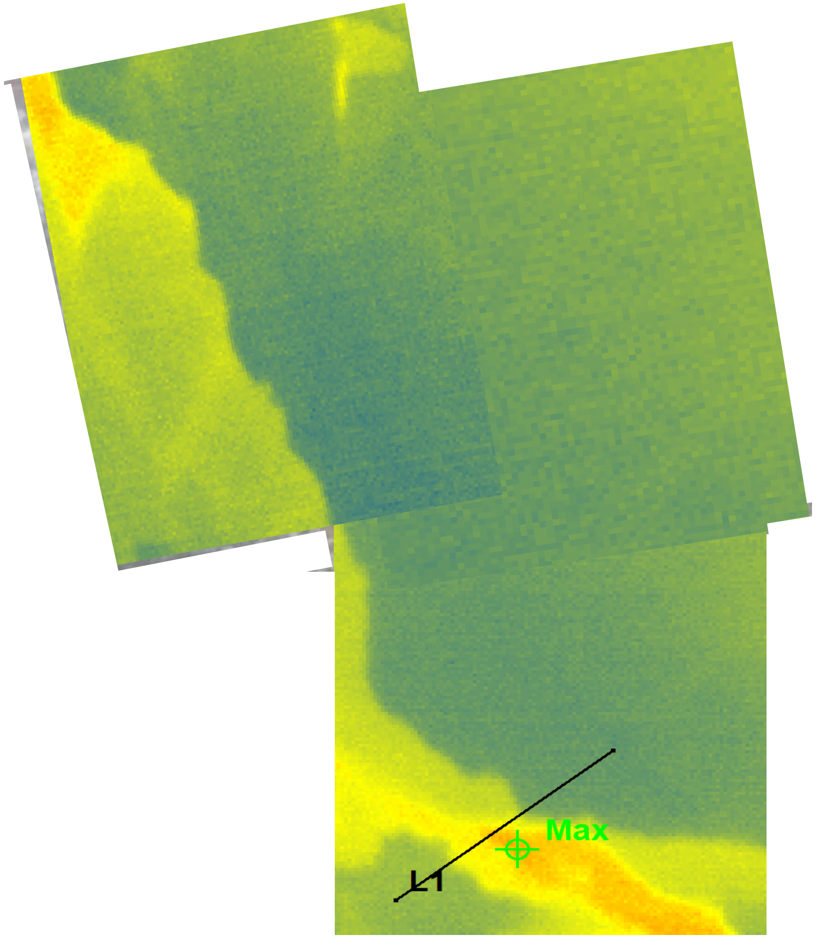
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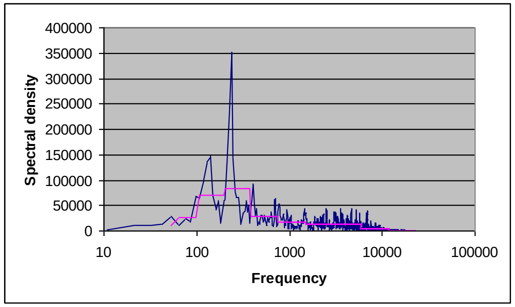
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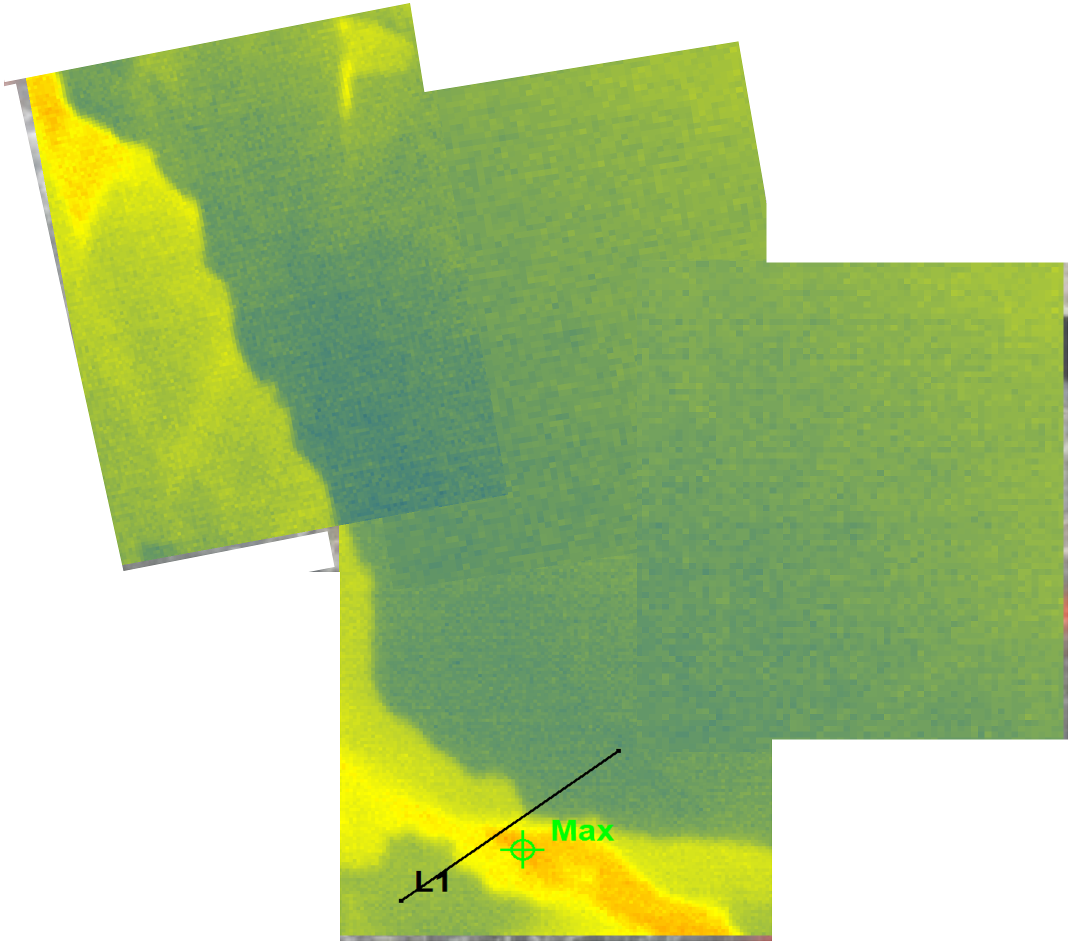

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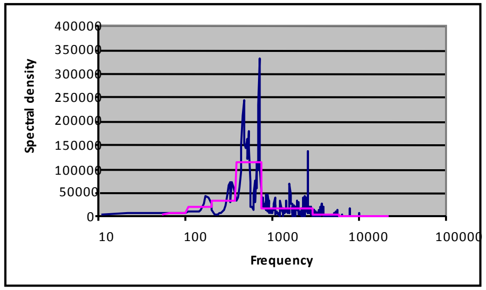

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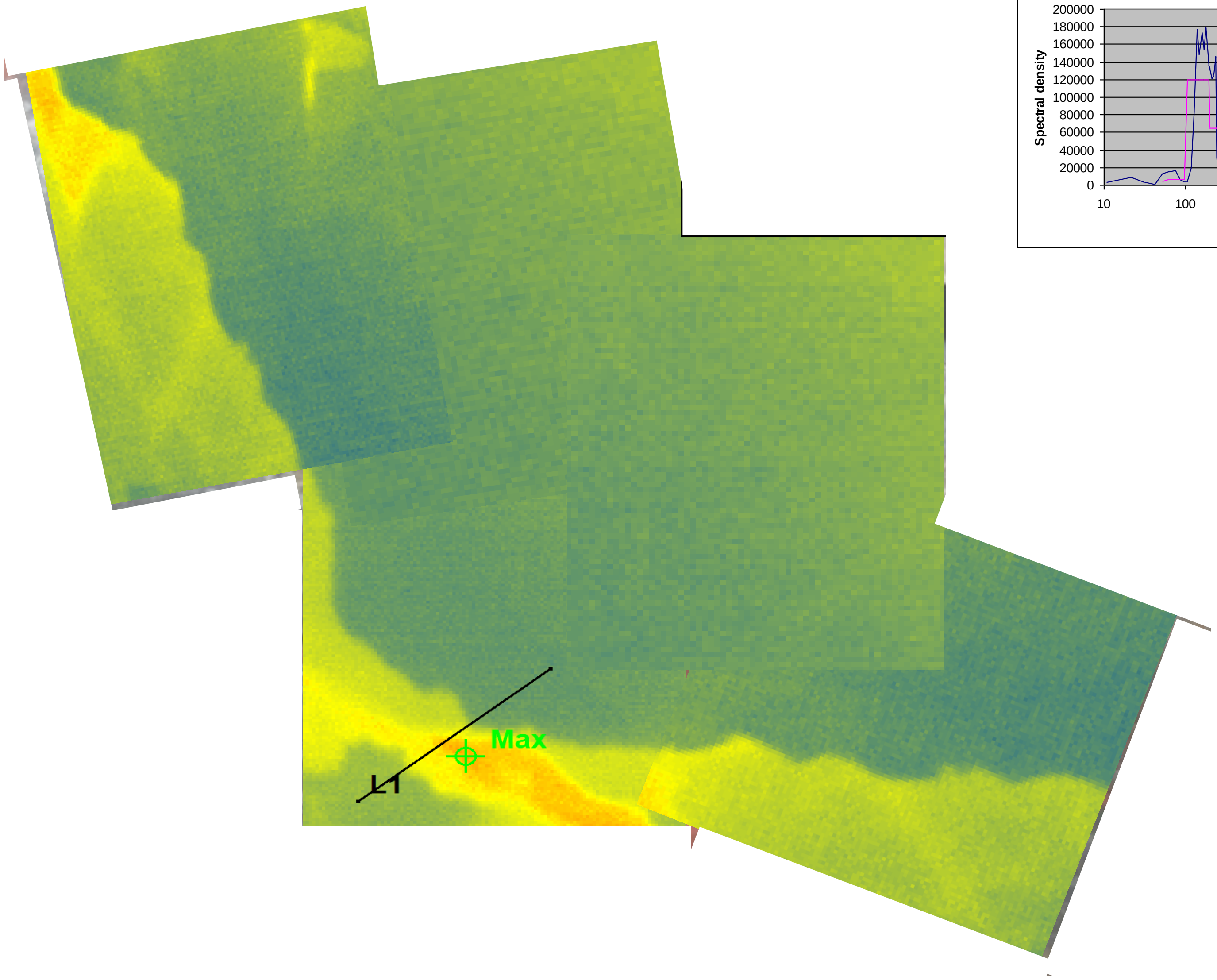

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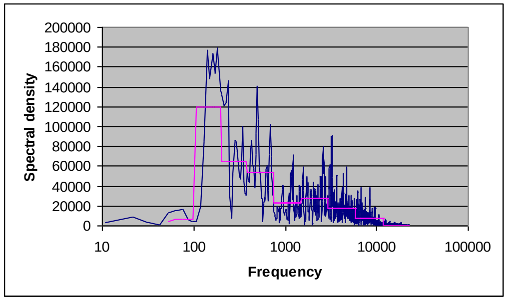

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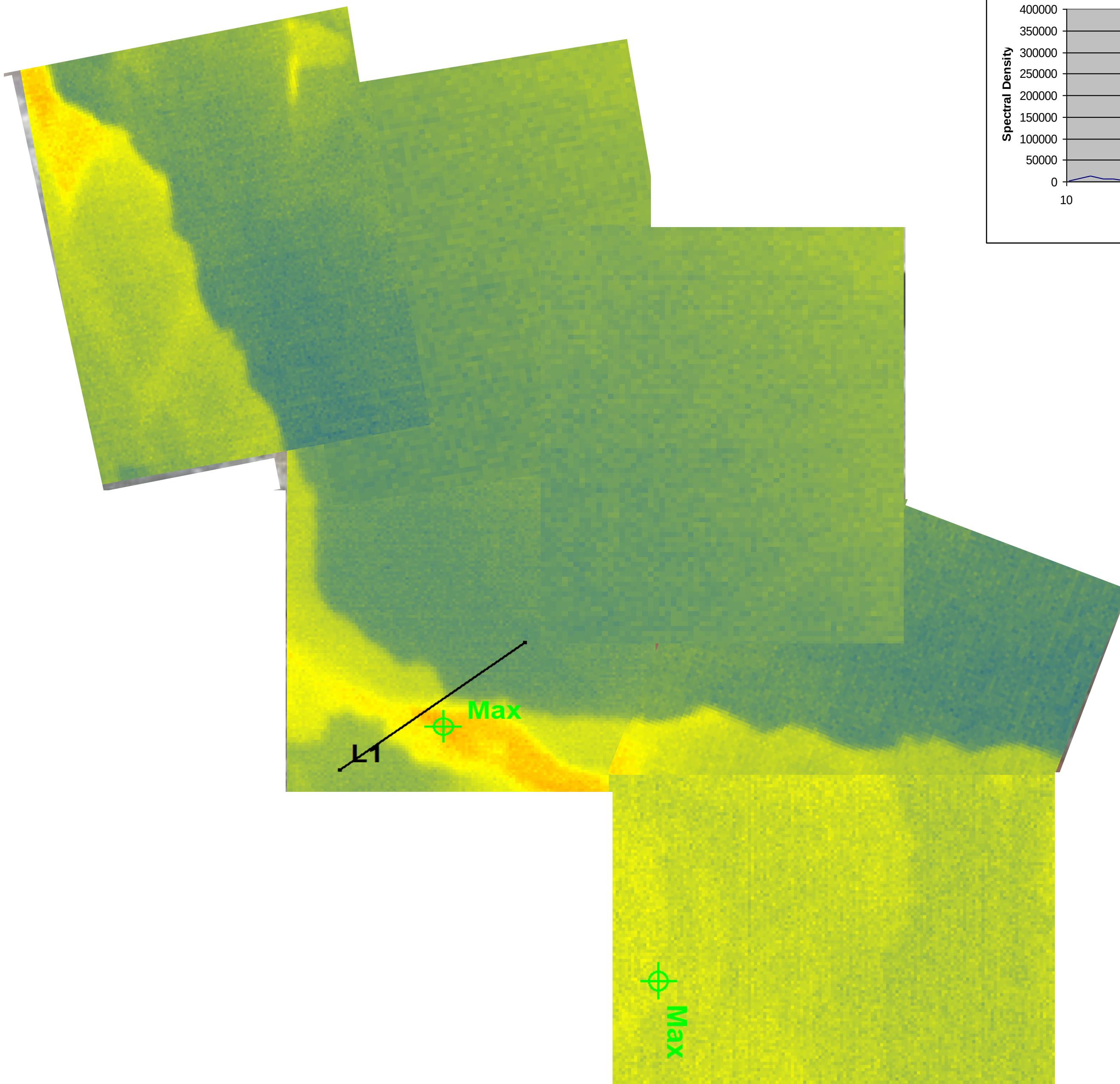
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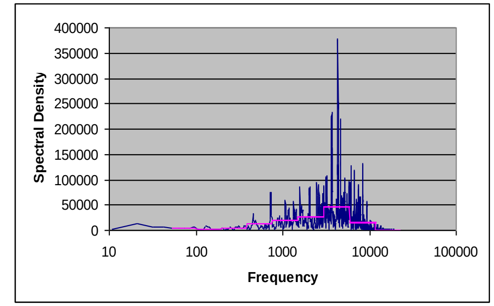
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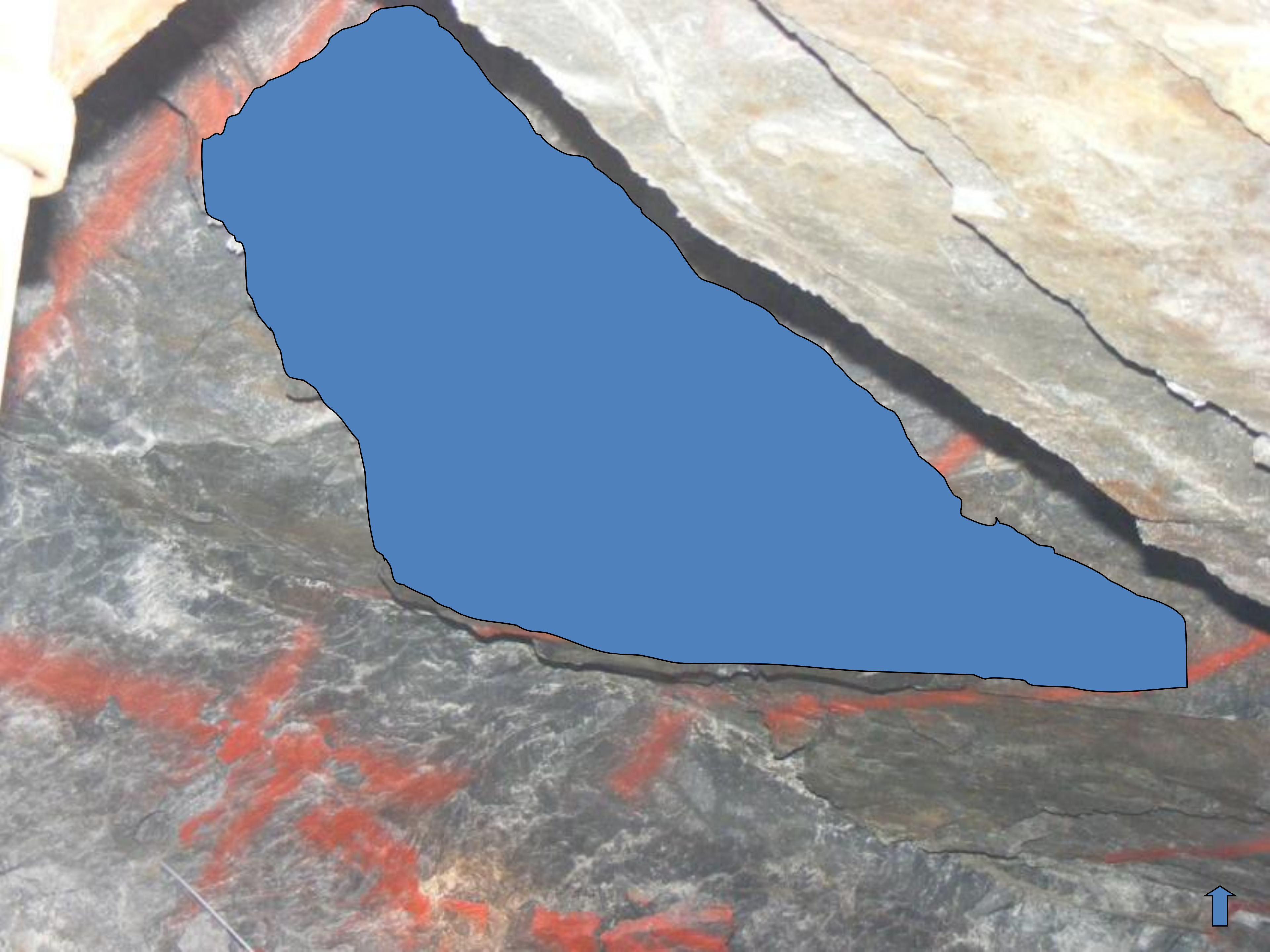
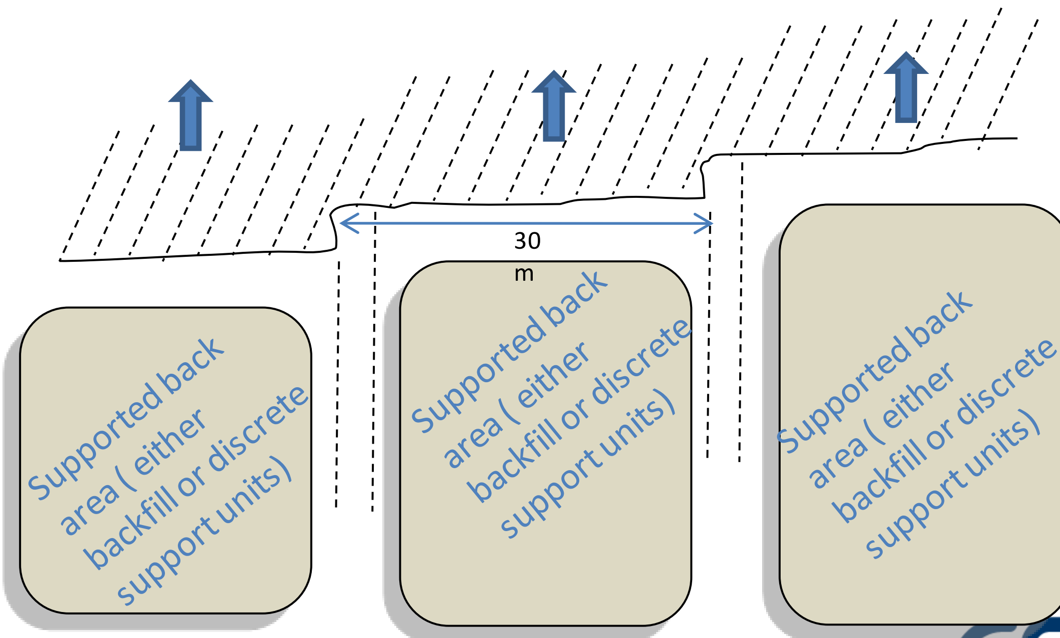


AziSA applications

- **Gas sensing flammable gas in hard rock mines**

Partners: CSIR, Miraka
SINTEF, Norway.



AziSA: The Future

- An *open* standard that all hardware vendors can use
- Practical engineering experience in flexible infrastructure that is robust enough for the challenges of the mining environment
- A data infrastructure that can serve purposes other than safety-critical monitoring, such as communication to the working area
- A standard way to represent all mine data and make it available for different consumers
- Using artificial intelligence techniques to monitor many data sources and provide effective high-level input to decision-makers, without drowning them in details

Thank you

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