TIG10 b Field Operations Geophysical operations – tools and methods

Des FitzGerald

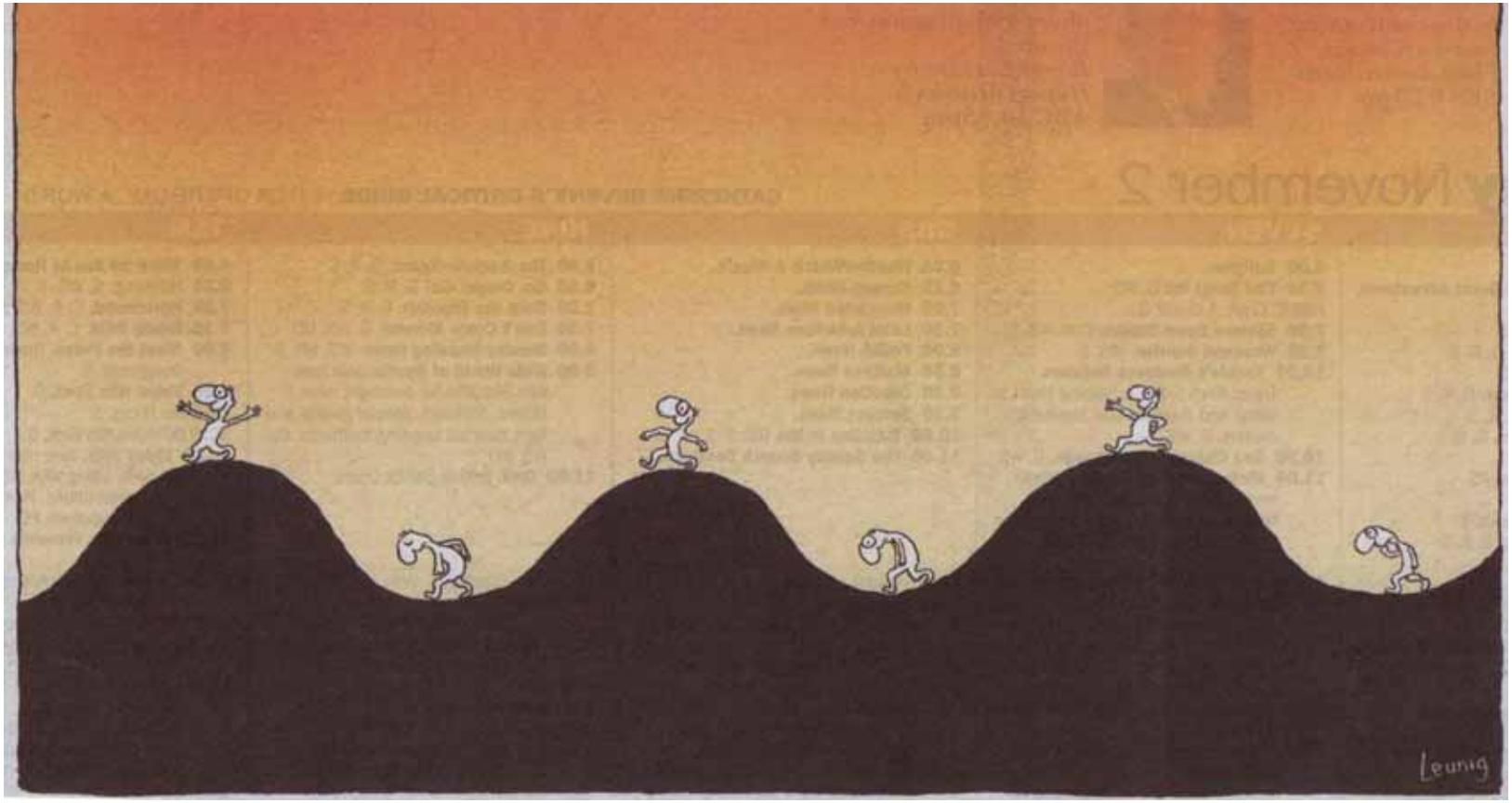
&

Helen Gibson

Australian Geothermal Energy Group

INTREPID GEOPHYSICS

Do we feel the energy?



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Talk Summary

TIG Definition

- What is appropriate for this TIG?
- Can we tease out a strategic agenda?

TIG Activities

- Format for activities
- Meetings in November
- Members list

Some technical extracts

- From the inaugural meeting

Australian Geothermal Energy Group

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Proposed Scope

To establish a framework for the:

characterisation of a Geothermal Play through **knowledge** of geophysical and thermal rock **properties**, & so facilitate

accurate geophysical, geological and heat flow **modelling** on all scales

(regional to prospect)

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- Lets start considering all things geophysical !
  - Heat flow
  - Seismic
  - Gravity
  - Magnetics
  - Radiometrics
  - MT
  - etc.

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Possibilities

- Micro-seismic networks
  - Design of monitoring
  - Interpretation of hypo-centre locations
  - Integration of results with a 3D geology model
- Advection anisotropy (stress field, mapping fractures)
- Address geological uncertainty (potential fields/geostatistics)
- Correct adaptation of rock properties
  - For geological, geophysical & heat resource estimation
  - Develop a Tool-Kit for appropriate use & extrapolation pp data
- Remote sensing of surface heat

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Typical format for activities so far

- Workshops / Meetings
  - Hosted in Geological Surveys
  - Universities
- Occasional speakers in capital cities

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Inaugural meeting – TIG 10 b

- was held at University of Adelaide, 6th November 2008.

- Speakers:

Des FitzGerald (Intrepid), Philippe Calcagno (BRGM),

Graeme Beardsmore (HDR), Allan Clotworthy (SKM)

David Love (PIRSA)

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Inaugural meeting – TIG 10 b

- Agenda, PowerPoints and Minutes available:

- ftp://ftp2.dfa.com.au/public/geomodeller/userMeetingsandWorkshops/0811_GeothermalWorkshop_Adelaide_Powerpoints

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Next meeting – TIG 10 b

- Maitland, NSW – Thursday 27th November 2008.
- Hosted by Geological Survey of NSW

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TIG-10 b Membership list

- Des FitzGerald, Helen Gibson, Phil McInerney (Intrepid)
- Matt Zengerer (Assoc. GeoIntrepid)
- Graeme Beardsmore (HDR)
- Tony Meixner (G.A.)
- Philippe Calcagno (BRGM)
- Frank Horowitz (CSIRO)

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Possibilities

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Micro-seismic Monitoring Geothermal application notes

AGEG TIG10

D.J.FitzGerald

2008

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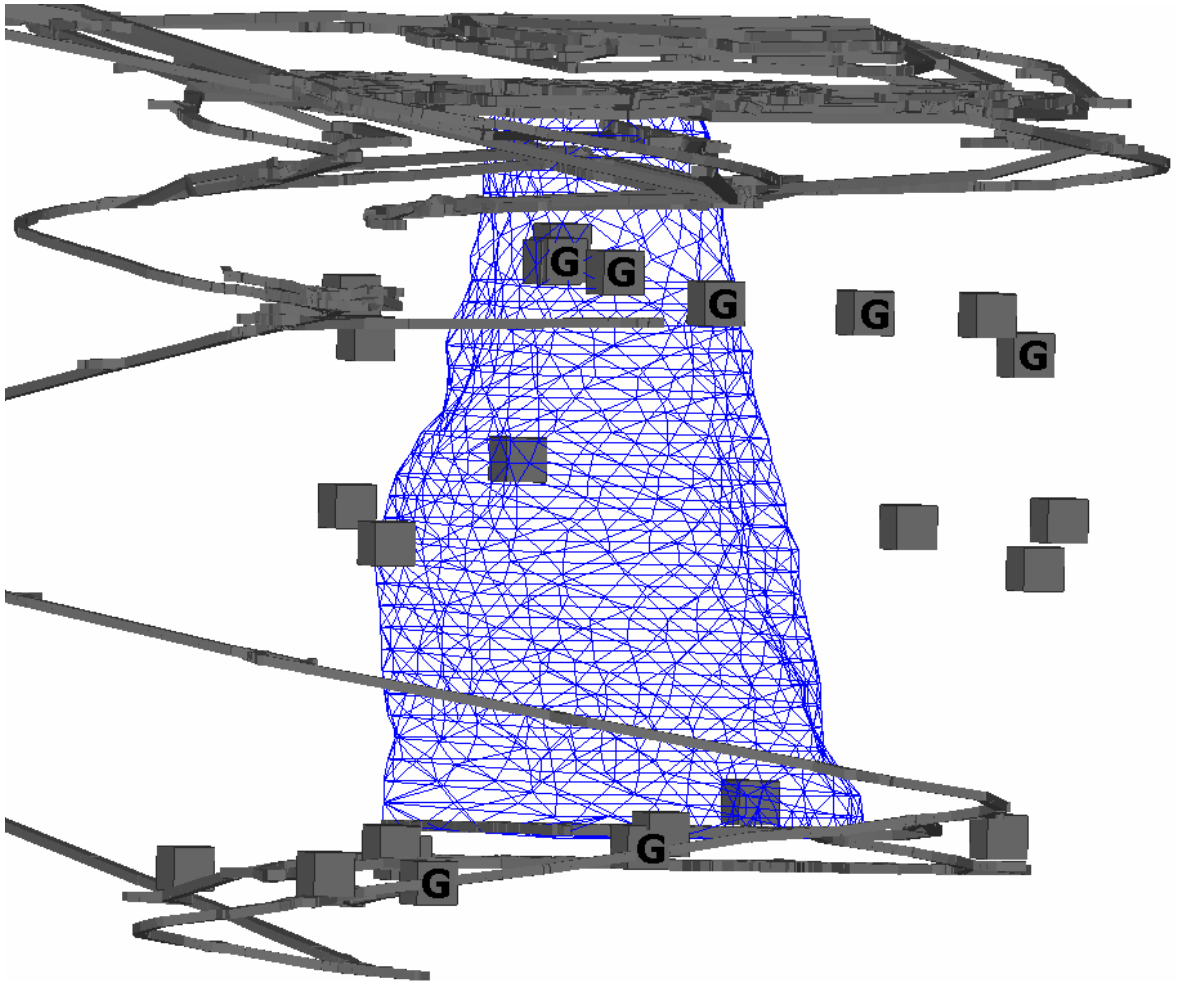
Location of Geophones



Good 3D distribution

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Geophone: 4.5Hz to 1000Hz

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How to locate seismic events in 3D?

- wish this was simply a matter of triangulating arrival times
- However, sound/energy travels at quite different speeds, depending upon density, geology, fractures

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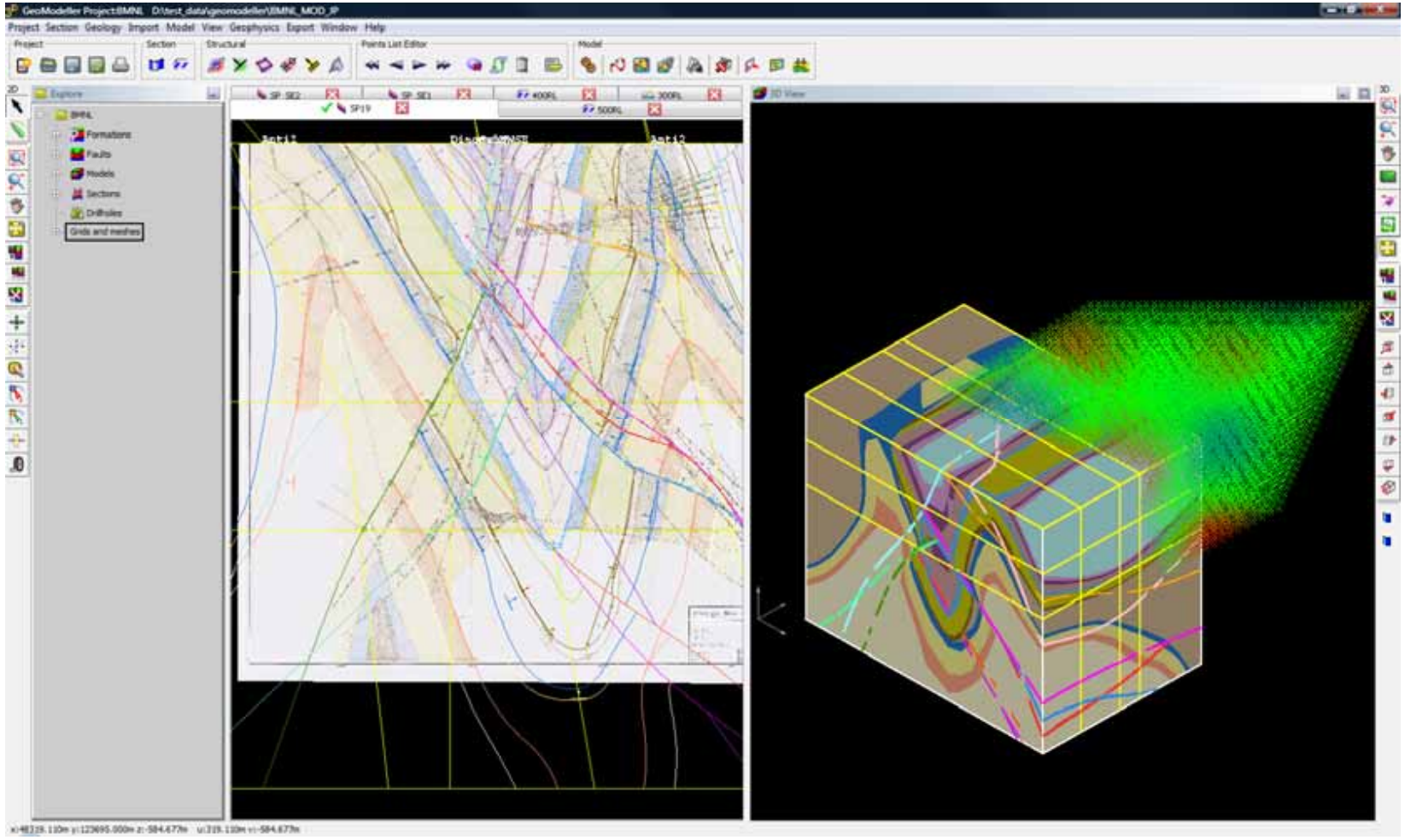
First - Create your 3D geology Model



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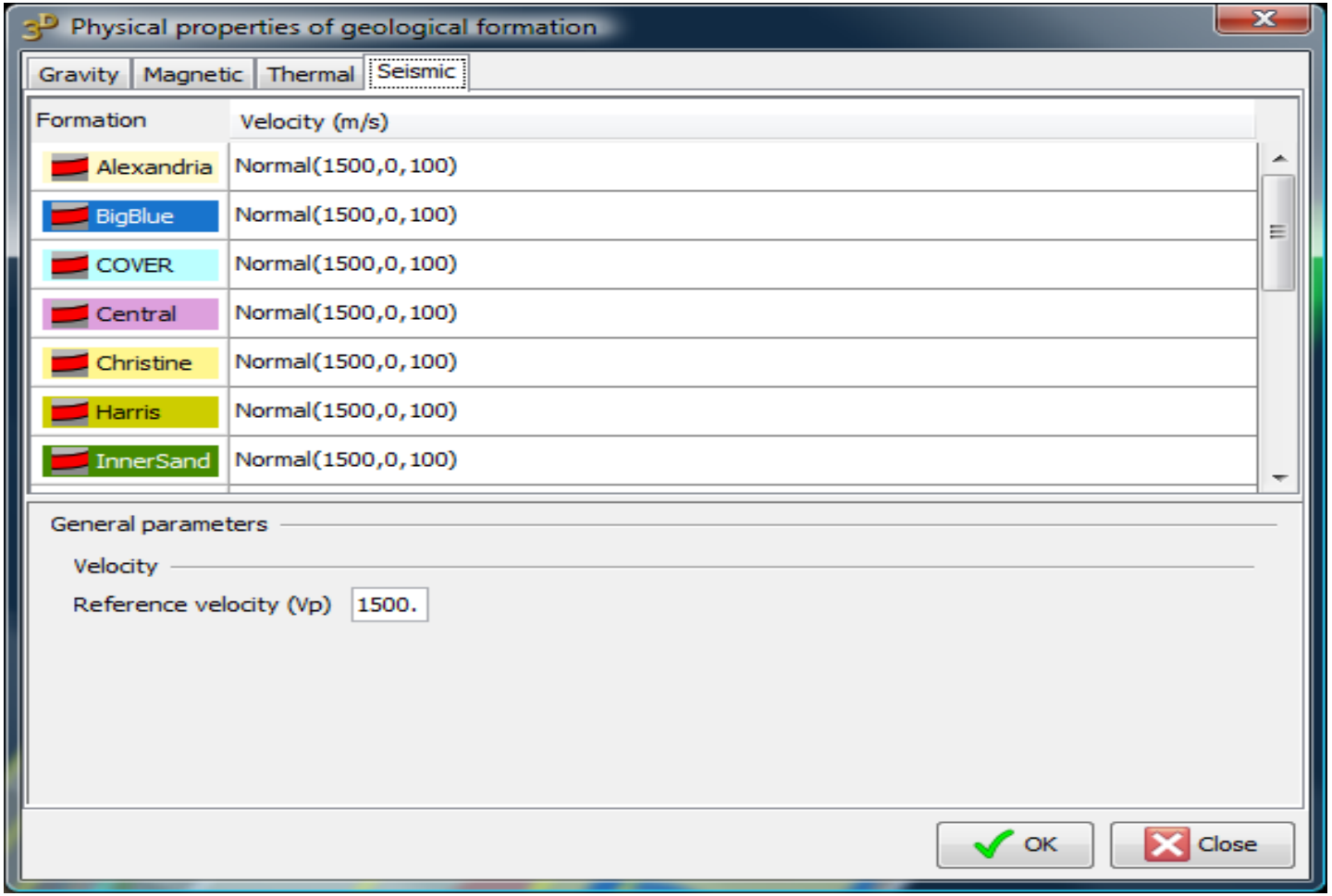
Second - propose a Velocity Model



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Third - Simultaneous structure and Hypo-centre determination

- Assumptions
  - P-wave arrivals for N stations
  - Times are related to velocities
  - errors have a normal distribution
- Minimize a miss-fit using an iterative fitting technique

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Outcome

- This approach leads to a more self-consistent seismic record that is interpreted in the context of your geology
- Your knowledge of the local stress field should also increase

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New Application of Technology ?

- A **bolometer** is a device for measuring the energy of incident electromagnetic radiation
- also known as a **thermal detector**
- Never been trialed in Australia
  (Currently being trialed in Africa / minerals)

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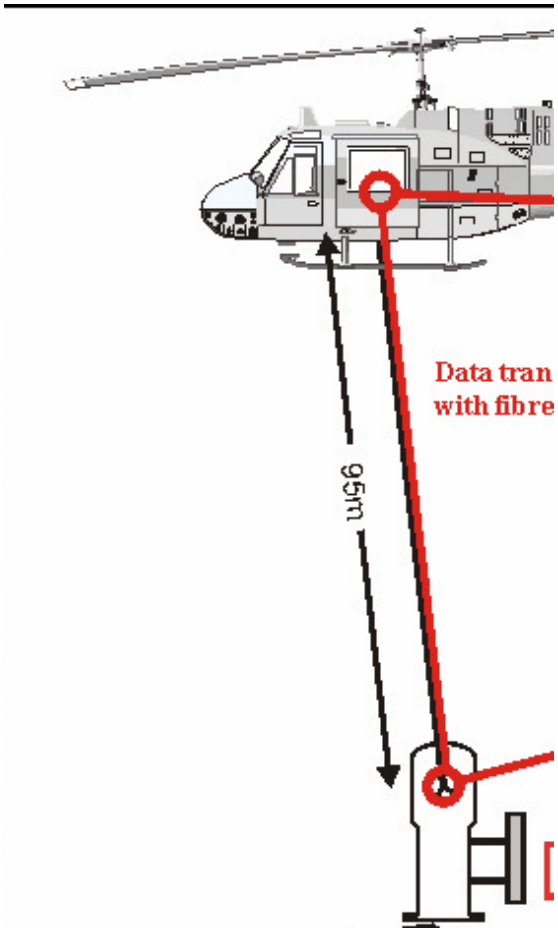
Rapid & Sensitive Bolometer

- **A Bolometer is a SQUID instrument,**

(Super Conducting Interference Device)

- **developed for NASA**



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Airborne System

- Cryogenic Bird on a bungee cord below a helicopter
- Rapid sampling rate – 1000Hz
- 100 times more sensitive than anything currently in use
- Use Helium to maintain 4 ° K
- Is packaged for easy deployment in 2 boxes

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Temperature anomalies have largely been overlooked as an exploration tool

- The following slides demonstrate differing aspects of thermal detection of hydrocarbons
- This also has implications for Geothermal Exploration

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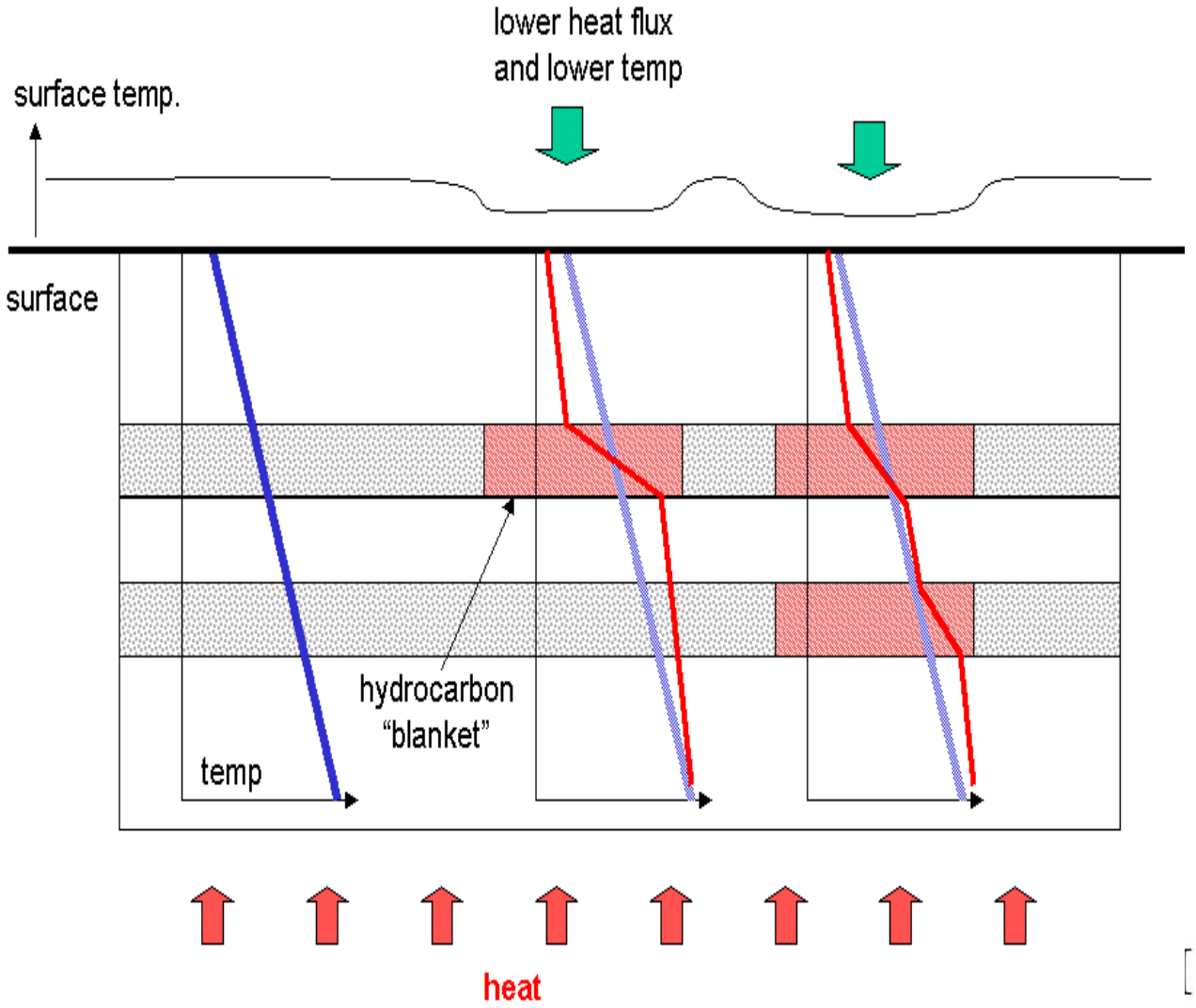
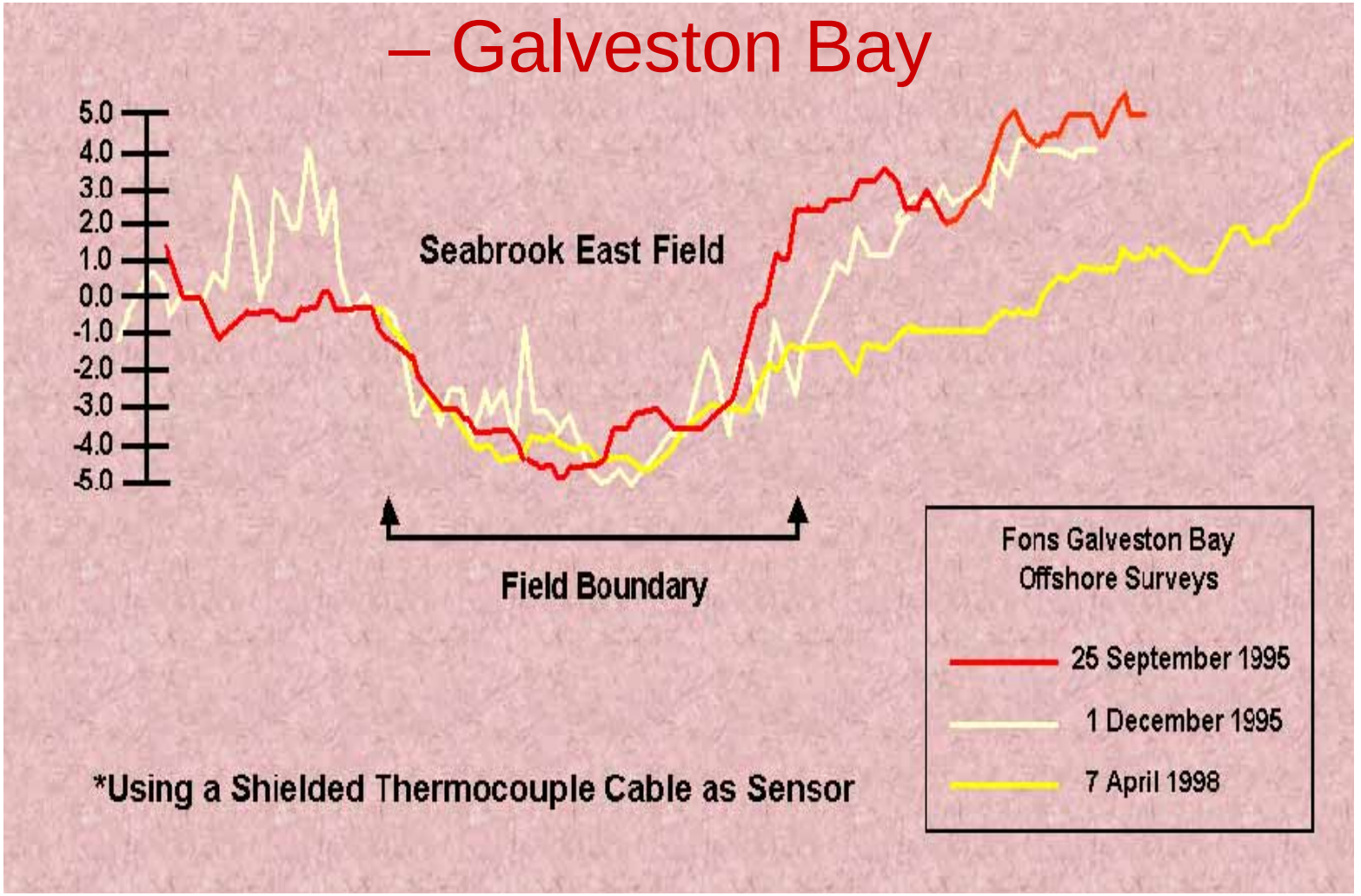
Hydrocarbons: Thermal blankets



Temperature probe dragged in sea water – Galveston Bay



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IPHT / Intrepid

- Have an agreement to work together (SQUID instrument)
- Are seeking a suitable demonstrator project
- Wish to find an Australian context to work in

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Other methods of remote thermal detection

- Borrow from Military / civil defence:
  Terahertz cameras

- Multi-spectral (HYVISTA)

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In summing up

Need to reduce scope of sub-TIG-10 b topics

- We're asking for your feedback

Open to other suggestions & contributions

- A case study / project ?
- Interesting problems ?
- Innovative technical objectives ?

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