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P08

Design Considerations for Cost Effective PMM Systems

I. Weir-Jone* (Weir-Jones / Terrascience Groups), P.M. Duncan, Ph.D. (Microseismic, Inc.), S.A. Shore, C.D., P.Eng. (Weir-Jones / Terrascience Groups) & S.M.J. Taylor, B.Sc. (Weir-Jones / Terrascience Groups)

SUMMARY

This paper provides potential users of passive microseismic monitoring data with an outline of the decisions which need to be made prior to deciding whether or not to deploy a PMM system, defining the system's specifications and issuing the statement of work to potential suppliers. It is also intended to summarize the issues and functional parameters which must be defined in order to ensure that the installed system will be useful for all stakeholders and that the actual installation process will be as stress free as possible.

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The factors which influence the decision making process include the following; they are not necessarily in order of priority:

1) What is driving the acquisition of a PMM system
   Mandated/Regulatory requirements?
   Operational requirements - frac monitoring, casing/tubular integrity etc.
   Long term reservoir monitoring and related issues
   Cost / Benefit analysis

2) Who will be the end user?

3) Is this a life of field, LOF, system or is to provide information about some specific event or procedure.

4) Is this to be a manned system or will it be automated?

5) What is the minimum size (magnitude) of microseismic event to be identified and located?

6) What type of events are anticipated?

7) What system resolution, temporal and magnitude, will be required by the stakeholders.

8) What deployment options are available, and what are the project cost implications of modifying them?

9) Do the stakeholders require real time data or can they accept delays in terms of hours or days?

10) Will surface site conditions impact the deployment of the systems?

11) Are there any other parties who may be affected by the decision to deploy a PMM system?

12) Type of trigger parameters: micro earthquake detection or local earthquake detection

13) Type of display: traces, real-time, 3D, or 4D (time stacked tomography)

The answers to these and other, related, questions will have a profound influence on the type of system which is deployed. In some cases i.e. localized frac monitoring, this may be a multi channel geophysical exploration style system deployed for a few days with a large field crew. In other cases it will be far more cost effective to deploy a PMM system which has been specifically designed for long term unmanned operation. Integrated into this latter type of system will come the appropriate acquisition and processing software to provide event location and characterization as well as the appropriate operator interfaces. The authors

review their recent experience with a variety of systems designed to achieve quite different objectives and summarize decisions which have had significant cost applications for end users.

Figure #1 shows an initial conceptual layout for a PMM system using twenty eight 24 channel TMA-24 data acquisition units.

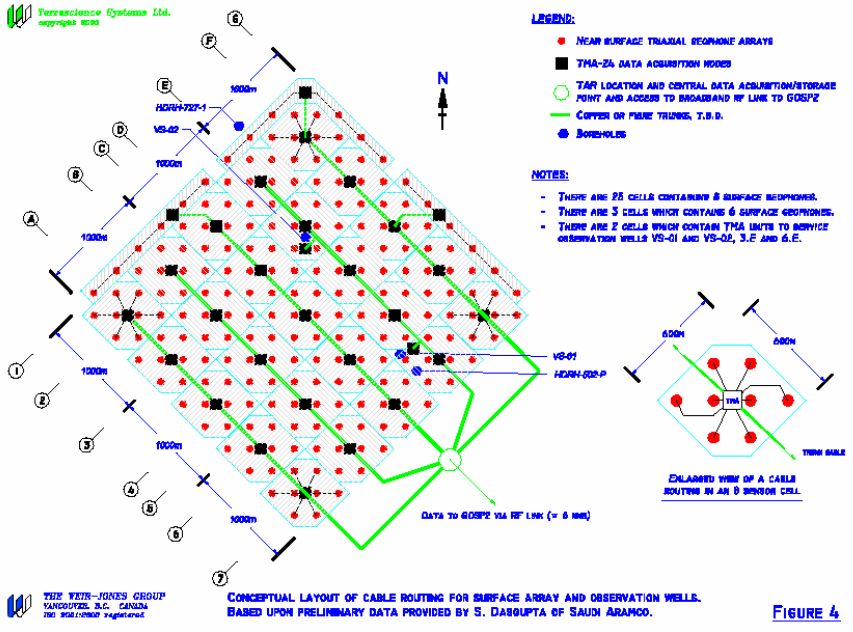


Figure #2 shows a revised conceptual layout for the same PMM system after a cost benefit analysis which employs two hundred and thirty 3 channel TMA-24 data acquisition units. This proved to be the favourable choice in this scenario as it significantly reduced the amount of surface analogue cabling.

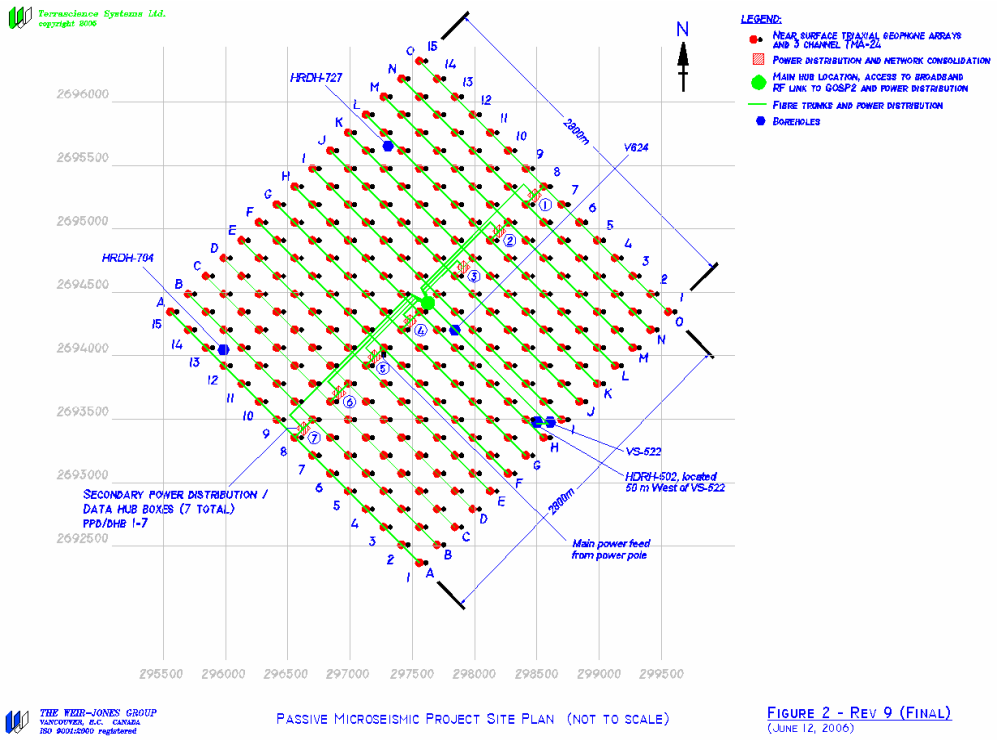
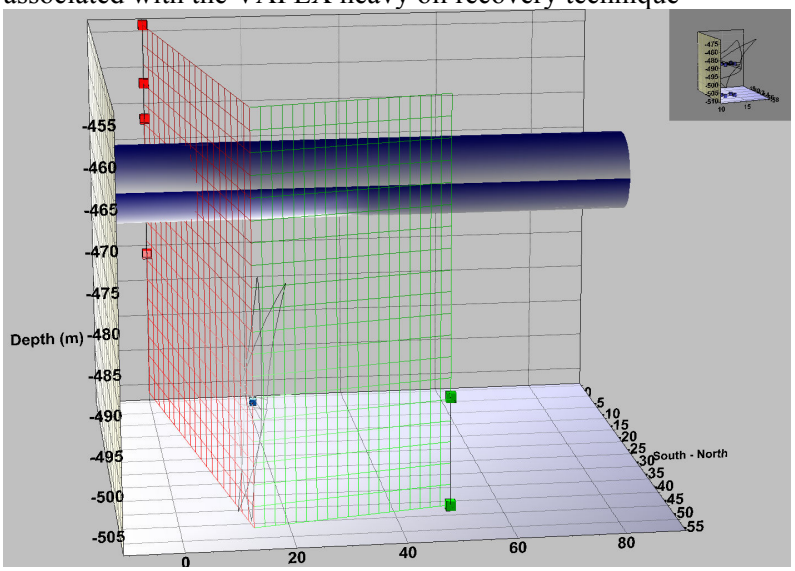
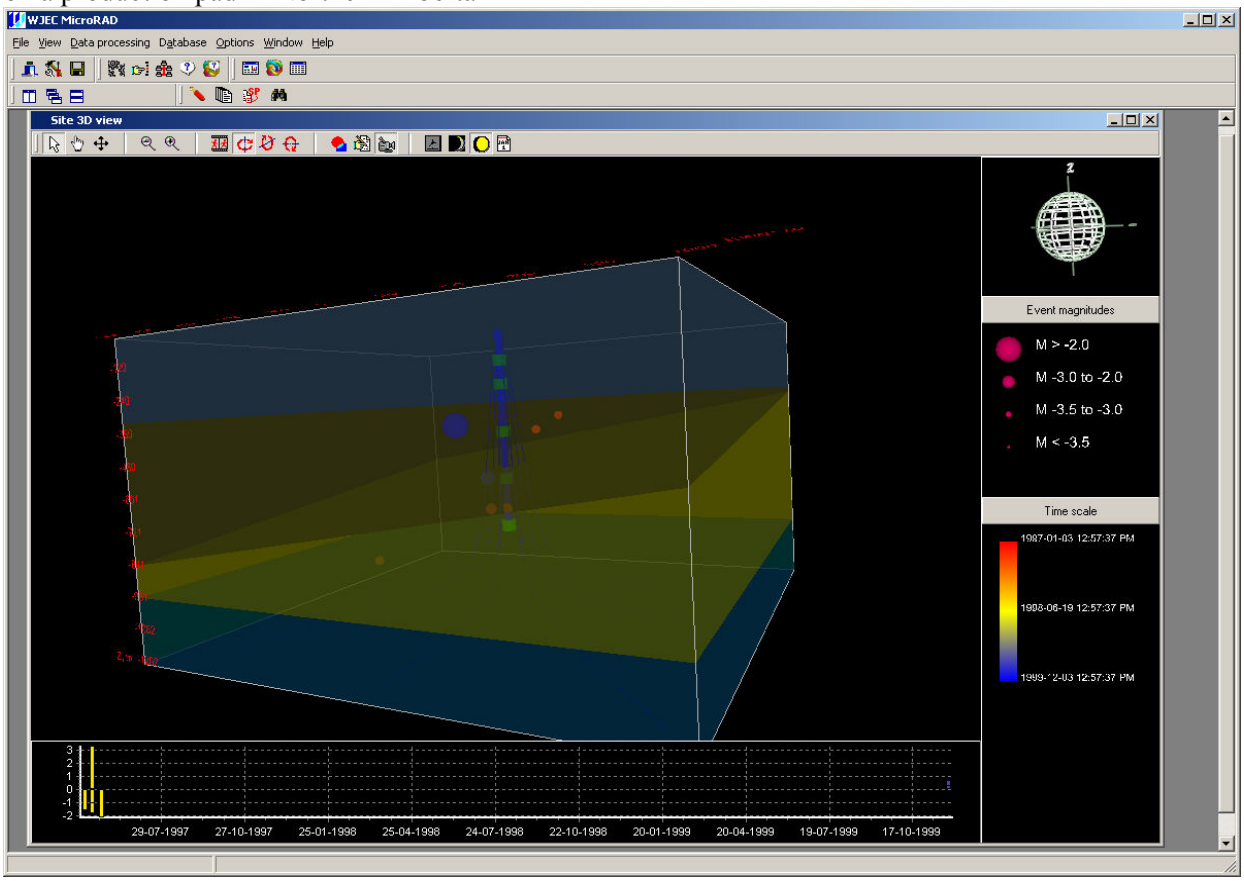
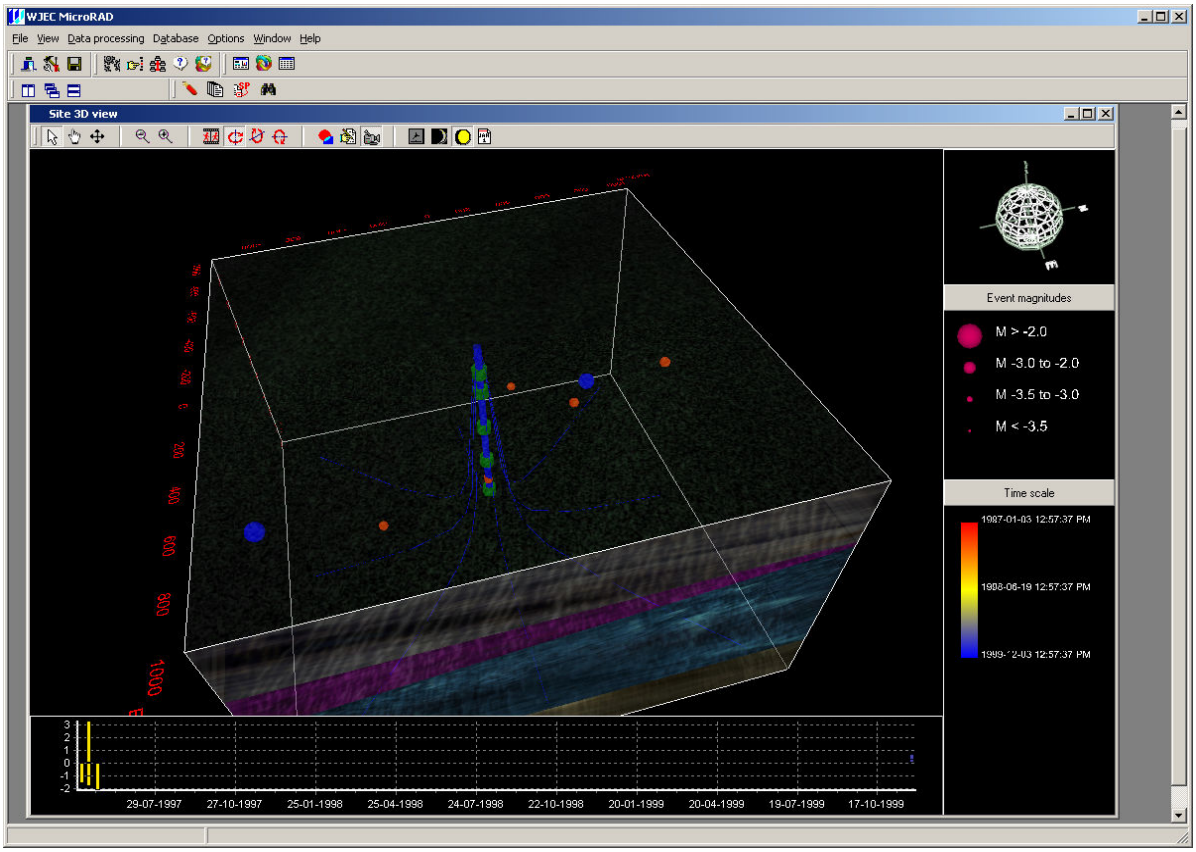


Figure 3 Shows visualization in real time of the hypocentres of microseismic events associated with the VAPEX heavy oil recovery technique



Figures 4 &5 Shows event hypocenters from a downhole observation well permanently placed on a production pad in Northern Alberta




WJEC MicroRAD
File View Data processing Database Options Window Help
Site 3D view
Event magnitudes
M > -2.0
M -3.0 to -2.0
M -3.5 to -3.0
M < -3.5
Time scale
1998-06-19 12:57:37 PM
29-07-1997
27-10-1997
25-01-1998
25-04-1998
24-07-1998
22-10-1998
20-01-1999
20-04-1999
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