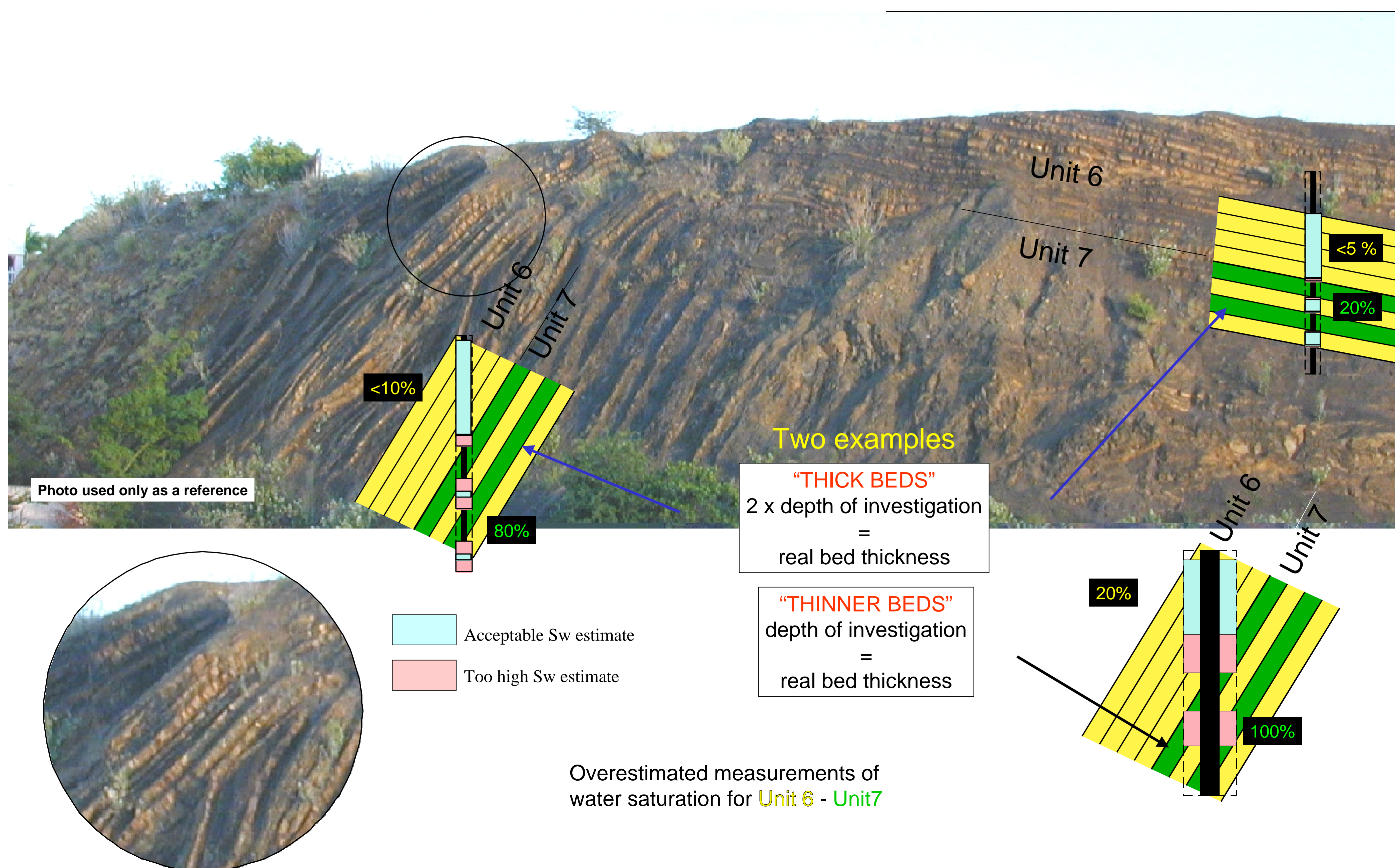


# WATER SATURATION DEPTH TRENDS



**Fig. 25 A simple analogue to summarize the apparent change in water saturation as a function of dip and of bed thickness**

The figure to the left (Fig. 25) shows an outcrop analogue to illustrate the problems related to the existence of too high water saturation measurements in alternating sandstone shale sequences, and more particularly when the sandstones beds are thinner.

The error related to the saturation is increased with an increase in dip as well as with a decrease in thickness of the sandstone beds. The problem is essentially due to the way an induction log operates (Anderson et al. 1995 and Allen et al. 1997).

The statistical identification of the abnormally high water saturations in the low Net-to-Gross intervals and the understanding of their geographic distribution will help pinpoint where beds may be highly dipping.

These findings can be extrapolated for the sandier intervals where saturation may be correctly measured but where the thickness is abnormally high because of the dip; in such cases this information could be used to make isopach-corrected thickness maps, even if the correction is only semi-quantitative.

Finally, the values of dips so obtained may be input into more advanced petrophysical modeling applications.

## CONCLUSIONS

Net-to-Gross maps are very useful to understand and review sedimentary environments, additionally N/G values can be used as a decompaction factor in order to quality control a stratigraphic correlation.

A Quick Look Dip Evaluation has been devised using the ratio between the decompacted thickness of a unit and the equivalent thickness in a reference well. In one part of the Santa Barbara Field, the Quick Look Dip Evaluation has corroborated the existence of a large fold and of some local detachment planes that have altered the apparent thickness of the unit and dramatically reduced the reservoir quality.

The traditional but very powerful Porosity Depth Trend Analysis gave new insight into the structural complexity of the area and has confirmed that the reservoir quality deterioration is not linked to lateral facies changes but are due to tectonically derived processes. The scale of the structural complexity identified includes features not resolved by 3D seismic mapping.

Visualization of petrophysical averages in 3-D has enabled a much clearer picture of the thickness, porosity, and water saturation variations and has given a set of new tools that will help understand better the structure of the field. These new tools identify the zones where petrophysical parameters need to be corrected for the influence of folding and faulting.

## REFERENCES

- Allen, D. et al., 1995, Modeling Logs for Horizontal well planning and evaluation, Oilfield Review, Winter 95, p.47-63
- Anderson, B et al., 1997, New dimensions in Modeling Resistivity, Oilfield Review, Spring 97, p.40-56
- Chatellier, J-Y., Hernandez, P., Porras C., Olave, S. and Rueda M., 2001, Recognition of Fault Bend Folding, Detachment and Decapitation in Wells, Seismic and Cores from Norte Monagas, Venezuela, Search and Discovery (www.searchanddiscovery.com), AAPG, Tulsa, Oklahoma, USA, Article #40031.
- Chatellier, J-Y., Rueda M.E. and Olave, S., 2002, Variable structural style along the Furril Trend, implications for the development of these giant fields, Norte de Monagas, Venezuela, CSPG Annual Conference, Calgary, June 2002, extended abstract.
- Embid, S., Avila, M.T., and Salazar P., 2001, From PVT Laboratory to Field: Development of a Methodology for the Areal and Vertical Characterization of Fluids, SPE 69396, 14 pages
- Fisher, Q.J., Casey, M., Clennell, M.B. and Knipe, R.J., 1999, Mechanical compaction of deeply buried sandstones of the North Sea, Marine and Petroleum geology, Vol.16, p. 605-618.
- Giles, M.R., 1997, Diagenesis and its impact on rock properties: A quantitative perspective, Kluwer Editors, 520 pages.
- Moreno, M., Chatellier, J-Y., Campos, O., Gonzalez G. and Brito, L., 2002, Integrated study of Santa Barbara Field: a core analysis gives a solution to the structural and stratigraphic complexity, Core workshop, Edited by J-Y. Chatellier and E. Sampson, Virtual Sedimentology Congress, February 2002, 42 pages
- De Waals, J.A., 1986, On the rate type compaction behaviour of sandstone reservoir rock, Unpublished PhD, technische Hogeschool Delft, The Netherlands, 166 pages.

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