Recognizing the Structural Control of Sedimentation in Clastic Sequences: From Correlation Problem to Geological Solution*

Jean-Yves Chatellier[1] and Omar Colmenares[2]

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[1]Tecto Sedi Integrated Inc., Calgary, AB, Canada (jchatellier@shaw.ca)
[2]Consultant, Toronto, ON, Canada

Abstract

Understanding that the sedimentation has been structurally controlled can be vital in establishing a reliable geological model, estimating the reserves properly or choosing the best drilling locations. This presentation will detail a series of methods to outline sedimentary patterns linked to tectonic control of sedimentation in clastic sequences. Tools and rules will be described that deal with differentiating syn-sedimentary control of sedimentation from post sedimentation tectonic overprint. The first task is to recognize structural alteration post sedimentation using wireline logs (Figure 1) or making use of other observations (thicknesses, facies, sedimentary patterns...).

Field examples from Europe, South America and Asia will show that unconformities and other structural elements can be overlooked if a reference well is used to establish the stratigraphy (Figure 2), an otherwise excellent and recommended practice.

Introduction

Simple tools, often forgotten, include detailed biostratigraphy that can be invaluable in establishing the proper correlations. It can also help identify a structural control of sedimentation (Figure 3) and sometimes help discover the next hydrocarbon pool (e.g., turbidites of the Gannet F field UK). Recognizing structural activity can also come from core observations; examples from the Nelson field (UK) outline the relative timing of these events (Figure 4) and pinpoint areas where compartmentalization can pose problems in accessing the known reserves.

Discussion and Conclusion

The faults controlling sedimentation may not be the same through time; that makes recognition and understanding uneasy. So far, the best modeled sequence of variable control pattern have been found associated with strike slip settings when sedimentation is first controlled by riedel shears and then by the main strike slip fault; the Seria field in Brunei will be used as a real case example with direct implications for development drilling.

All of the 13 wells marked in red (Figure 2) are missing the same stratigraphic unit whereas none of the close neighbors are missing the same interval in one field of the North Sea. The official interpretation is one of normal faults cutting all of these wells at the same stratigraphic level. The alternative option proposed here is of a tectonically induced horst system with absence of sedimentation or with erosion and reworking of the previously deposited non-consolidated sediments.

Another striking analogy with the Furrial example is the outstanding thick and blocky sand near the limits of the horst. The blocky nature is indicative of a rapid vertical aggradation that is in line with a fault control of the sedimentation. In this example coal are laterally equivalent to the missing sections (paleosoils in Furrial).

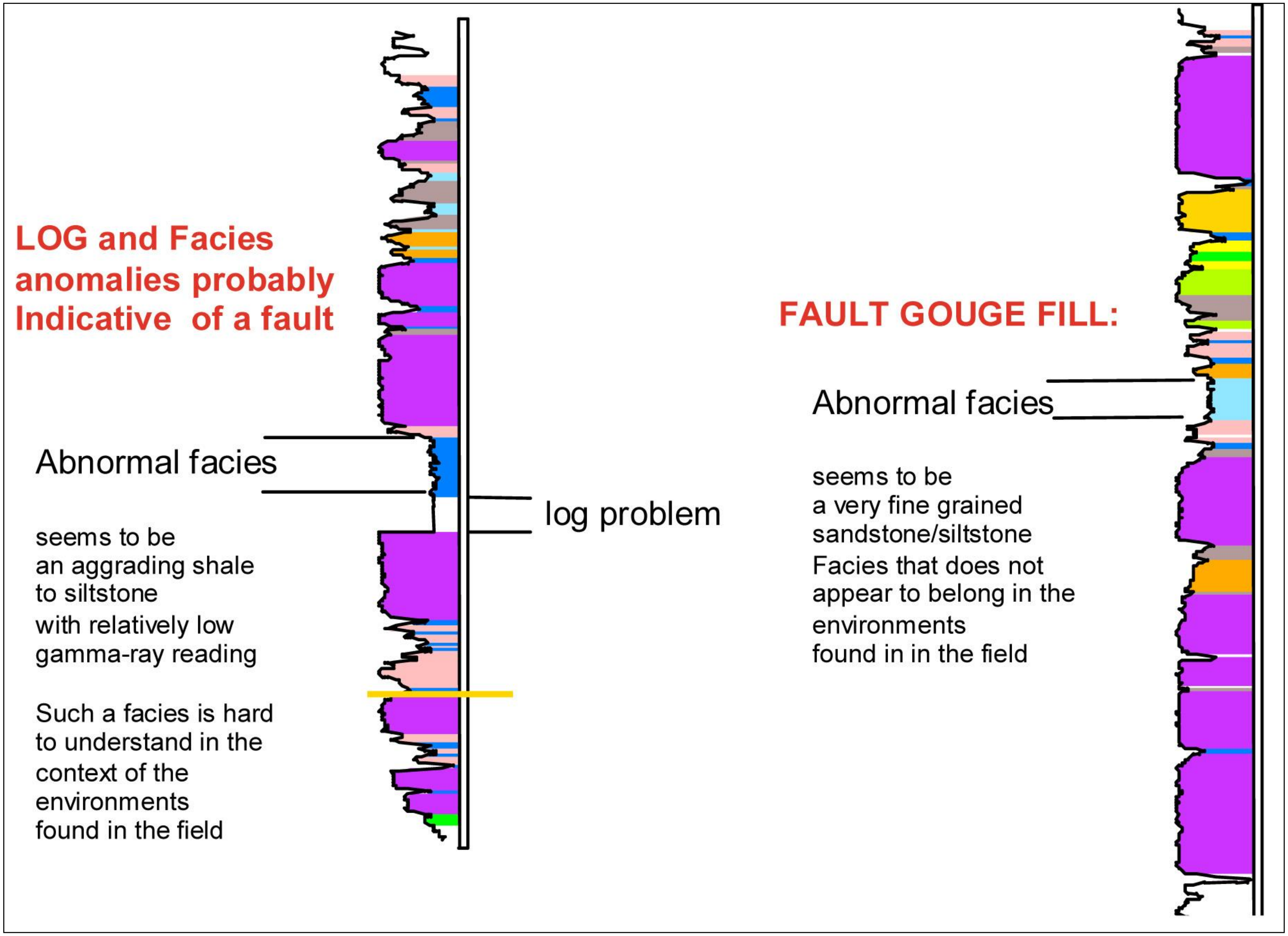


Figure 1. Typical log problems associated with the presence of a fault. Identification can lead to recognizing abnormal thickness changes.

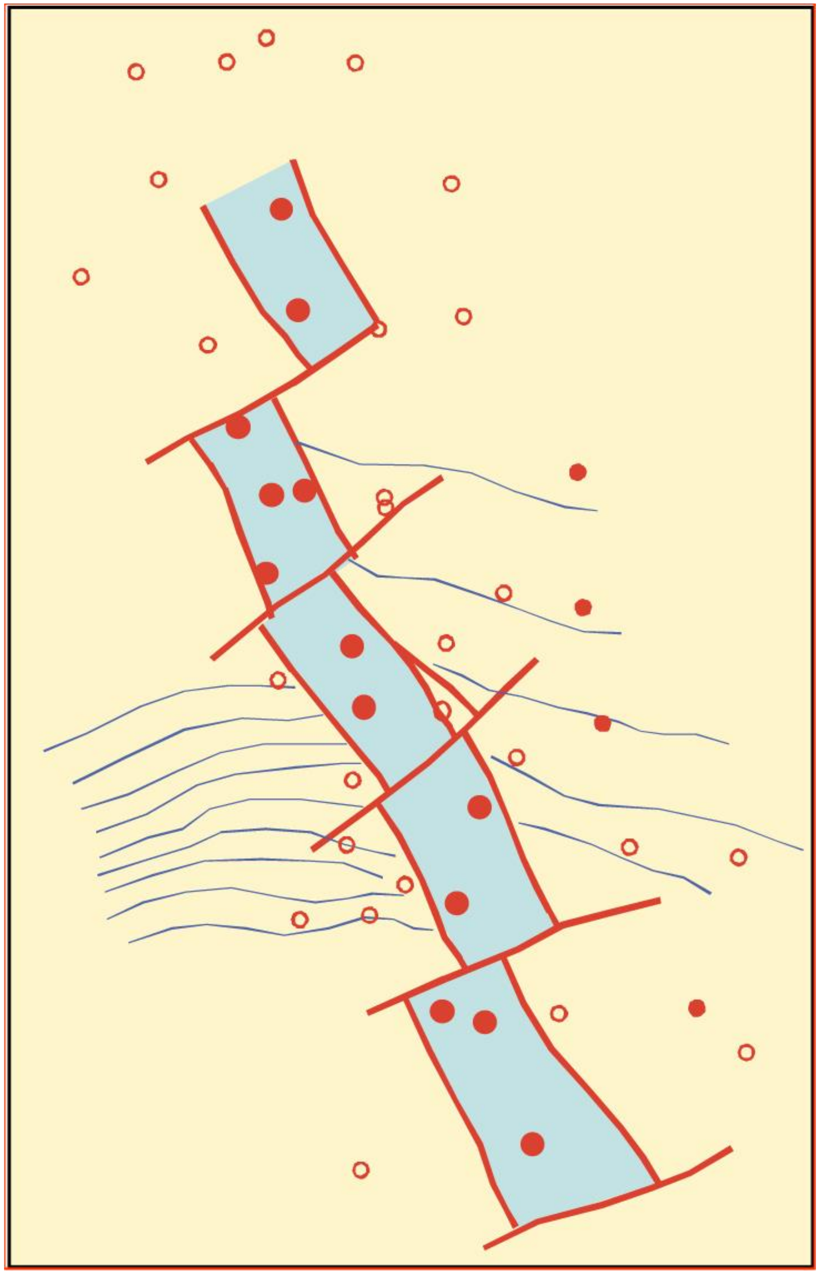


Figure 2. Schematic map view of the structurally controlled Upper Ness E unit (Brent Group) in the Dunlin Field, UK.

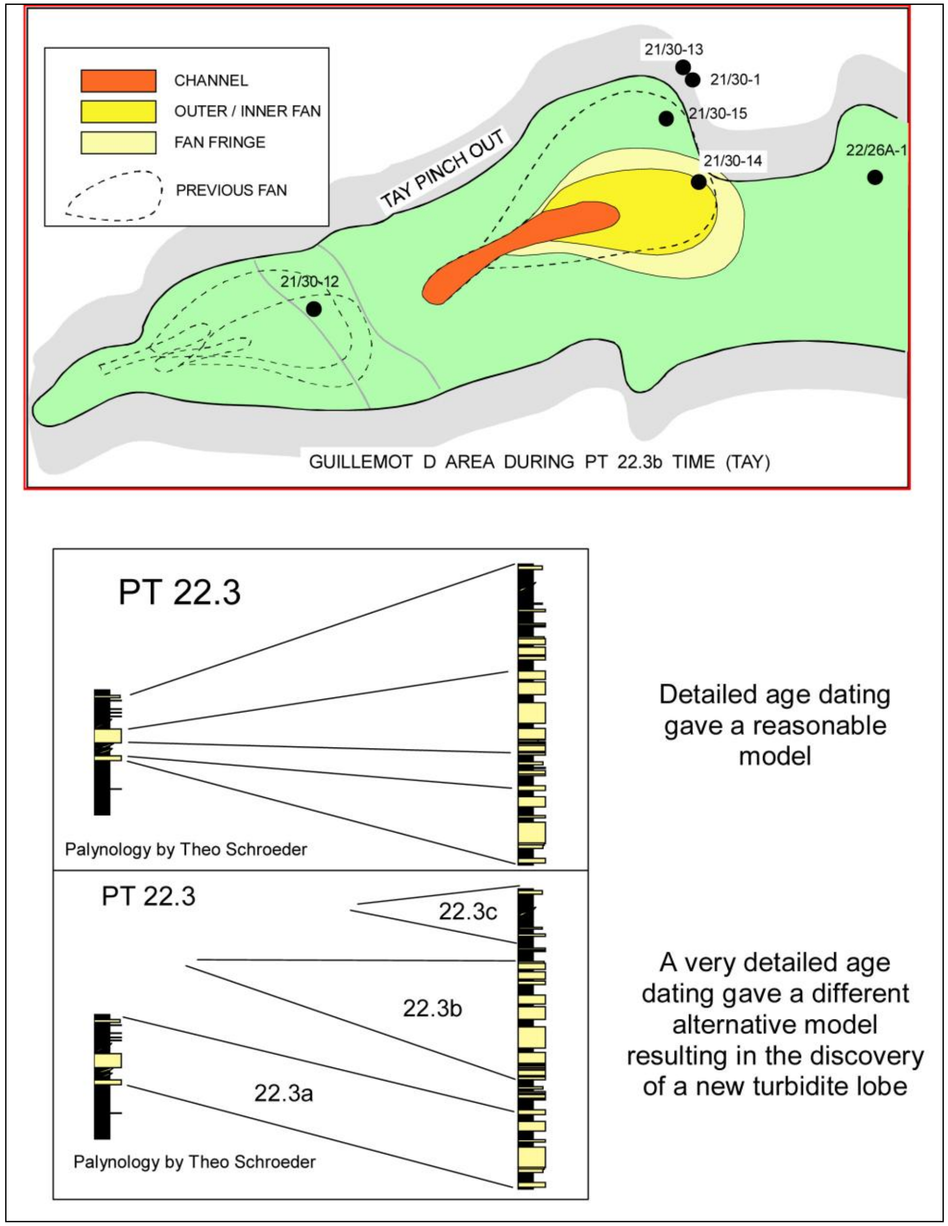
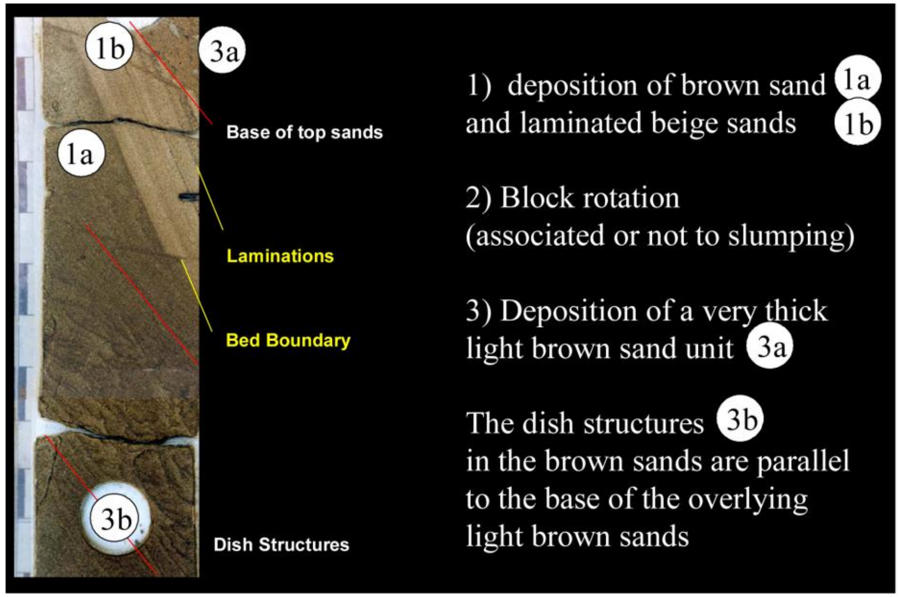


Figure 3. Detailed palynology delivers an alternative geological interpretation invoking structural control of the Tay turbidite sands in the Guillemot D/Gannet F Field (UK).



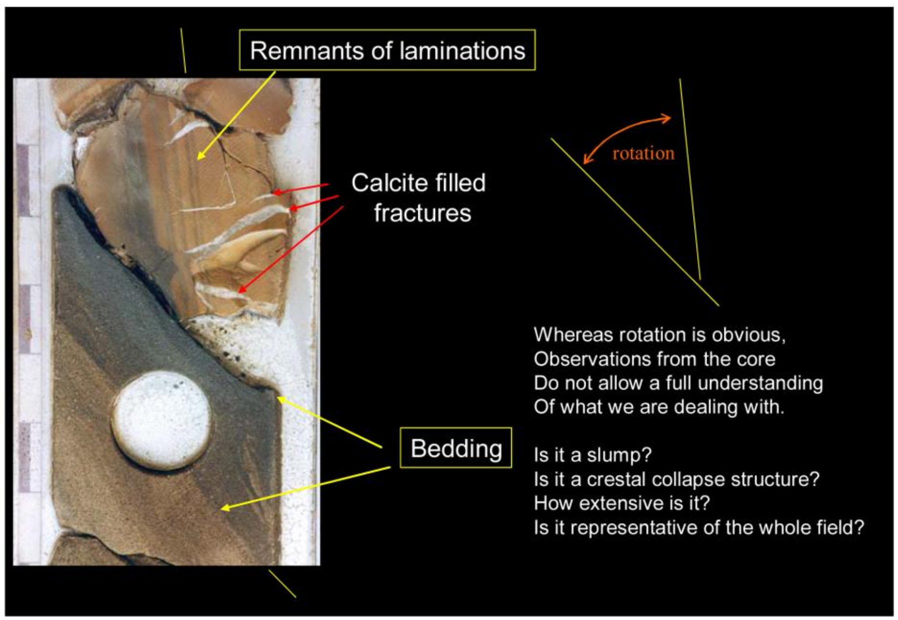


Figure 4. Examples of core features indicative of synsedimentary tectonic activity in the Forties turbidite sands (Nelson Field, UK).