[EA]Benefits of a Chronostratigraphic Framework, An Example from the Papuan Fold Belt*

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Search and Discovery Article #51676 (2020)**
Posted August 17, 2020

*Adapted from extended abstract prepared in conjunction with oral presentation given at 2020 AAPG/EAGE 1st Petroleum Geoscience Conference & Exhibition, PNG's Oil and Gas Industry Maturing through Exploration, Development and Production, Port Moresby, Papua New Guinea, 25-27 February 2020
 DOI:10.1306/51676Maxwell2020

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Abstract

The Late Jurassic to Early Cretaceous strata of the Papuan Basin were deposited in an overall transgression, with regressive events that resulted in the deposition of shallow marine sands (Home et al., 1990). These sands form the main hydrocarbon-bearing reservoirs in the Papuan Fold Belt (e.g. Toro and Hedinia sands in the Toro and Imburu Formations, respectively). The distribution and lateral extent of these sand bodies are of critical importance to future exploitation.

Discussion

Historically, lithology and wireline log motifs were correlated between wells (lithostratigraphic correlation) with field focused biostratigraphic constraints (Davey, 1999). The tripartite partition of the Toro Formation into the Toro A, B, and C sands is a typical example. Caution should be taken with lithostratigraphic correlation methods as there is a risk of miscorrelating similar lithologies occurring at different stratigraphic levels (Welsh, 1990). The long lasting near-shore to marginal marine systems (Jenkins and White 1970) have resulted in a number of similar wireline log motifs in wells (e.g. shoreface, mouth bar and estuarine lithofacies (Figure 1)).

Lateral facies changes can only be confidently mapped if correlation between wells utilizes a chronostratigraphic framework. This framework must be constrained by detailed biostratigraphic analysis.

Santos has adopted and applied a chronostratigraphic scheme linked to the biostratigraphy that provides the potential to correlate similarly aged sediment packages from the North West Shelf, Browse and Timor Sea basins in Australia across to the Papuan Basin. These surfaces signify major depositional episodes such as sequence boundaries and flooding surfaces that provide a framework enabling subdivision to reservoir scale. An example from the Papuan Fold Belt is shown in Figure 2 and compared back to the traditional lithostratigraphic nomenclature of the reservoir sands (Toro A, B, and C).

Most PNG wells have comprehensive palynological control below the Tertiary limestones. This provides stratigraphic information while drilling to identify formation changes, casing points, coring points, repeat sections etc. Wells in the fold belt have varying vintages of palynological data from a relatively low number of company/consultant palynologists. The early data is variously ascribed to the zonations of Helby, Morgan, and Partridge (1987), BP Production, (Welsh, 1990) as well as the widely adopted and adapted Robertson Research scheme of Davey (1987 and 1999). More recently Horizon/MGP have provided high quality stratigraphic monitoring using a modified version of the Davey (1999) palynological scheme. The general high quality and consistency of the range chart distribution data enables reinterpretation with respect to the latest datums for most of the legacy wells.

Santos in-house biostratigraphers have applied a consistent approach to interpretation of legacy range charts in wells across the basin and correlated major surfaces along a strike section in the highlands of PNG (Figure 3).

It is apparent that using a chronostratigraphic scheme, sands in fields to the northwest of the basin are time equivalent to shales in in fields to the southeast, and visa-versa.

In the Agogo and Iagifu wells, the first sand package, traditionally ascribed to be the Toro A, is an EK10-11 sand. This sits above the K20 sequence boundary that has cut down into the older more typical and widespread EK12 sand. In contrast the sands ascribed to the Toro A in Hides are entirely EK12 in age and capped by an extensive EK12 shale. Similarly, the sand package below the K13MFS in Hides (Toro C) is seen to shale out to the east.

Employing this chronostratigraphic scheme, a greater understanding of the lateral variation of sand development across the Papuan Basin is gained. This insight is valuable for exploration purposes as well as enhancing our understanding of the reservoir systems across the developed fields.

References Cited

Cant, D.J., 1992, Subsurface Facies Analysis, *in* R.G. Walker and N.P. James (eds.), Facies Models: Response to Sea Level Change: Geological Association of Canada, St., John's, Nfld, ISBN: 0919216498, 409 p.

Davey, R.J., 1987, Palynological Zonation of the Lower Cretaceous, Upper and Upper Most Middle Jurassic in the Northwestern Papuan Basin of Papua New Guinea: Department of Mineral Resources, Geological Survey of Papuan New Guinea, Memoir 13, ISBN: 9980810939, p. 1-77.

Davey, R.J., 1999, Revised Palynological Zonation for the Late Cretaceous, Early Cretaceous, and Late Jurassic of Papua New Guinea: Geological Survey of Papuan New Guinea, Memoir 17, ISBN: 9980812087, p. 1-51.

Helby, R., R. Morgan, and A.D. Partridge, 1987, A Palynological Zonation of the Australian Mesozoic, *in* P.A. Jell (ed.), Studies in Australian Mesozoic Palynology: Memoir of the Association of Australasian Palaeontologists, no. 4, p. 1-94.

Home, P.C., D.G. Dalton, and J. Brannan, 1990, Geological Evolution of the Western Papuan Basin, *in* G.J. Carman and Z. Carman (eds.), Petroleum Exploration in Papua New Guinea: Proceedings of the First PNG Petroleum Convention, Port Moresby, 12-14th February, 1990, p. 107-117.

Jenkins, D.A.L., and M.F. White, 1970, Report on the Strickland River Survey, Permit 46, Papua: BP Developments Australia Ltd., Repot 89, Geological Survey of Papua New Guinea, Data File 4BS (unpublished).

Welsh, A., 1990, Applied Mesozoic Biostratigraphy in the Western Papuan Basin, *in* G.J. Carman and Z. Carman (eds.), Petroleum Exploration in Papua New Guinea: Proceedings of the First PNG Petroleum Convention, Port Moresby, 12-14th February 1990, p. 369-379.

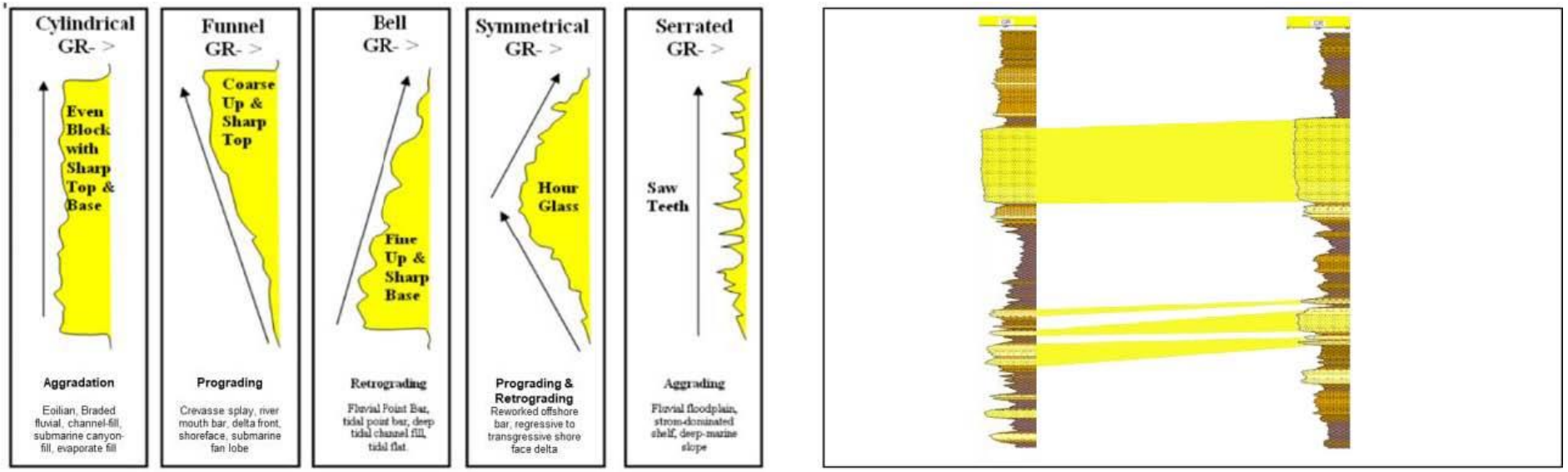

Figure 1. Left: Characteristic gamma-log patterns and their interpreted environment of deposition (Cant, 1992).
Right: Stratigraphic cross-section of 2 wells in the Papuan Fold Belt with a lithostratigraphic correlation scheme.

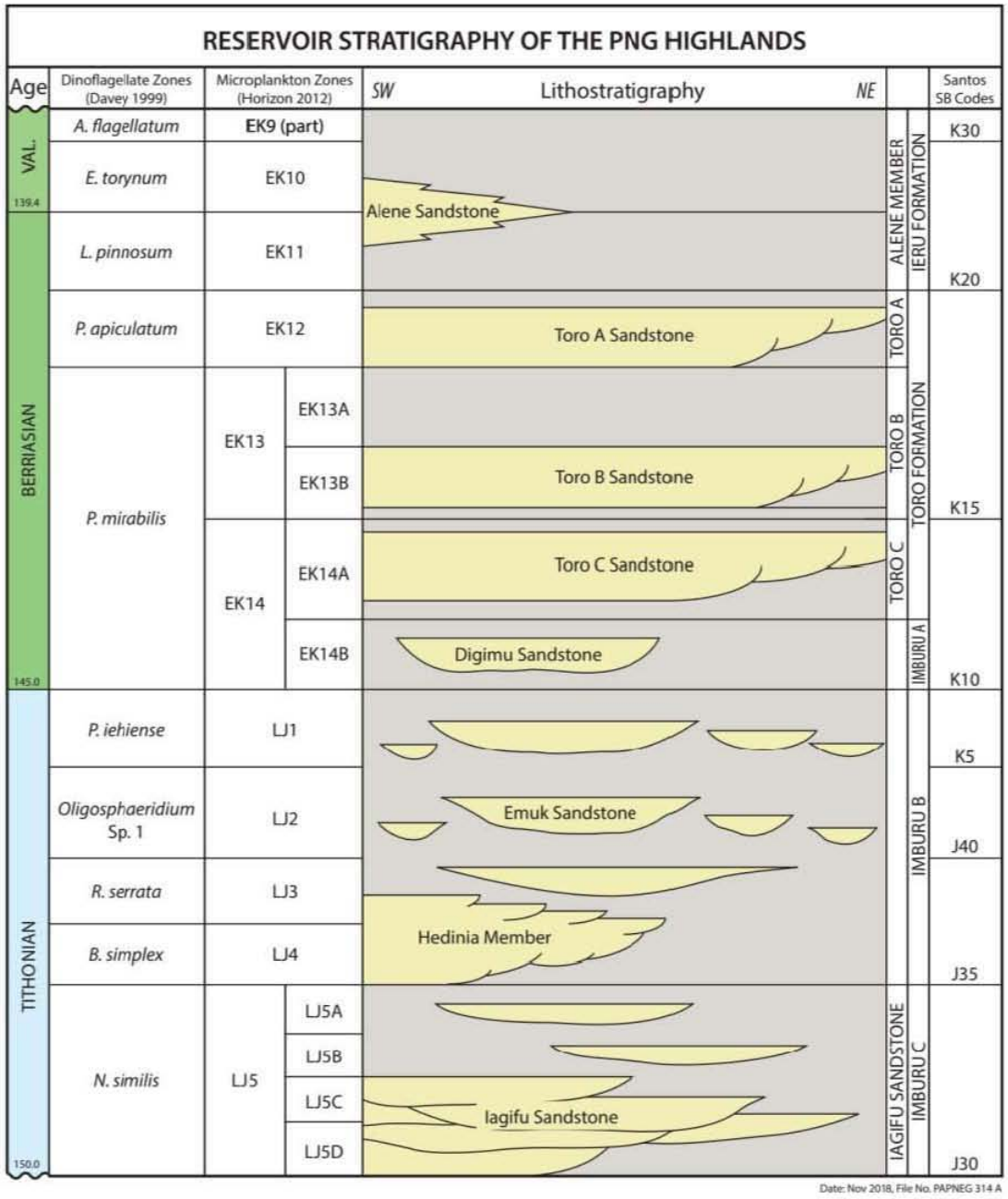

Figure 2. Chronostratigraphic Chart of the Papuan Basin Reservoir Stratigraphy, linking biostratigraphy and lithostratigraphy.

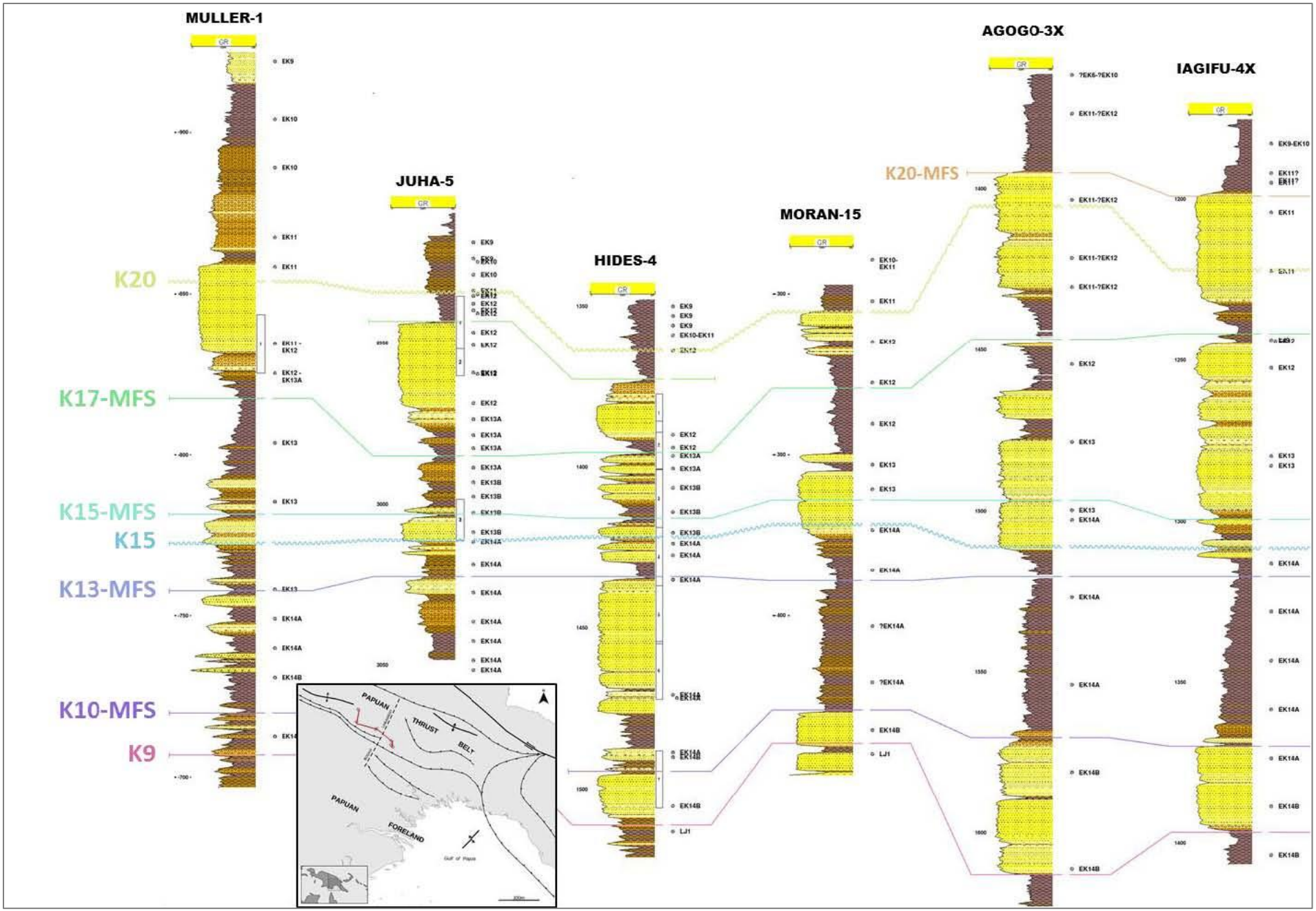

Figure 3. Chronostratigraphic cross section of wells from the PNG Highlands. Normalized GR filled with idealized lithology.