GSA Data Repository 2020157

Fuhrmann, A., et al., 2020, Hybrid turbidite-drift channel complexes: An integrated multiscale model: Geology, v. 48,
https://doi.org/10.1130/G47179.1

Table DR 1: Facies description and interpretation of the cored section of Well A

Facies	Description	Interpretation	Facies association
Fa 1	Normally-graded, parallel- and ripple-laminated fine- to very fine-grained, poorly sorted sandstones. Some beds show an increased mud content on laminations ripple foresets.	These beds are interpreted as low-density turbidites (*sensu* Bouma, 1962). The increased mud content in some beds may be due to increased entrainment in the flow or due additional mud entrainment in the channel by bottom currents (*sensu* Martin-Chivelet et al., 2008).	**Channel margin**
Fa 2	Fine to very fine, clay-rich, poorly-sorted banded sandstones with oriented mudstone clasts and with dish and pillar structures.	These beds are interpreted as transitional flow deposits (sensu Haughton et al., 2009).	**Muddy channel margin**
Fa 3	Mudstone- matrix, very poorly-sorted deposits, with common mudstone and sand-sized clasts, may show internal deformation and folded clasts.	The structureless and poorly sorted facies is interpreted to be have been deposited by laminar flow and interpreted as debrite deposit (*sensu* Haughton et al., 2009).	**Channel internal debrite**
Fa 4	Sandstones or mudstones that show convolute/chaotically deformed bedding or laminations.	The deformation is interpreted as post-depositional remobilisation and slumping of beds.	**Slumped/remobilized**
Fa 5	Mudstones interbedded with 5 to 10 cm thick clean sandstones and siltstones, which are sharp-based and fine upwards. The mudstone beds include starved ripples, and up to very fine grained sand streaks and strongly bioturbated to mottled. A coarsening upward trend is often observed at the transition from Fa 6 to Fa 5.	Sharp based, fining upward sandstone beds suggest turbidity current deposition. The interbedded poorly sorted mudstones with thinly, sharp-bases, sandstone laminae and starved ripples may indicate an influence of bottom current activity (Shanmugam, 1993; Martin-Chivelet et al., 2008). This facies is interpreted to be deposited by both, gravity-driven and bottom-current processes; thus forming a mixed turbidite-contourite deposit.	**Reworked overbank deposits**
Fa 6	Mud-rich siltstones of 0.5 to 2 m thickness, with parallel lamination, rare cross-cutting laminae and ripples; bioturbation occurs irregularly within this facies.	The continuity of grain size and bed thickness of this facies suggests a continuous, relatively weak, long-lasting flow.	**"Toes" of the contourite drift**

REFERENCES

Bouma, A., 1964, Turbidites: In Developments in sedimentology, v. 3, p. 247-256.

Haughton, P., Davis, C., McCaffrey, W., Barker, S., 2009, Hybrid sediment gravity flow deposits - Classification, origin and significance: Marine Petroleum Geology, v. 26, p. 1900–1918.

Martín–Chivelet, J., Fregenal–Martínez, M.A. and Chacón, B., 2008, Traction structures in contourites: Developments in Sedimentology, 60, pp.157-182.

Shanmugam, G., T. D. Spalding, and D. H. Rofheart, 1993, Process sedimentology and reservoir quality of deep-marine bottom-current reworked sands (sandy contourites): AAPG Bulletin, v. 77, no. 7, p. 1241–1259.

Table DR2: Deep-ocean turbidity currents (velocity refers to velocity maximum) measured by current meters

Location (Water depth)	Velocity [max measured]	Frequency	Duration	Flow thickness	Reference
Congo Canyon, Angola (2-4 km)	< 3 m/s	~11 per year	< 3 hours to 10 days	Up to 150 m	Khripounoff et al., 2003; Cooper et al., 2013; Azpiroz-Zabala et al., 2017
Gaoping Canyon, Taiwan (2-3 km)	< 1.6 m/s	~10 per year	< 22 hours	Up to 150 m	Liu et al., 2012; Zhang et al., 2018
Monterey Canyon, California (<2 km)	< 8 m/s	~10 per year	Up to 8 hours	Up to 80 m	Xu et al., 2004; Xu et al., 2011; Paull et al., 2018
Hueneme and Mugu Canyons, California (>4 km)	< 2.8 m/s	>4 per year	1 hours	Up to 25 m	Xu et al., 2010; Xu, 2010
La Fonera Canyon, NW Mediterranean (>1.2 km)	< 0.4 m/s	10s per year triggered by fishing or dredging	< 6 hours	>22 m	Palanques et al., 2006; Puig et al., 2012
Var Canyon, NW Mediterranean (1.2-2.4 km)	< 0.6 m/s	~3 per year	Up to 22 hours	>20 m	Khripounoff et al., 2009

REFERENCES

Azpiroz-Zabala, M., Cartigny, M.J., Talling, P.J., Parsons, D.R., Sumner, E.J., Clare, M.A., Simmons, S.M., Cooper, C. and Pope, E.L., 2017, Newly recognized turbidity current structure can explain prolonged flushing of submarine canyons: Science advances, v. *3*(10), p. 1700-2000.

Cooper, C., Olivier, A. and Wood, J.,2013, Turbidity current measurements in the Congo Canyon, *in* Offshore technology conference: Offshore Technology Conference, 2013.

Khripounoff, A., Vangriesheim, A., Babonneau, N., Crassous, P., Dennielou, B., & Savoye, B., 2003, Direct observation of intense turbidity current activity in the Zaire submarine valley at 4000 m water depth: Marine Geology, v. *194*(3-4), p. 151-158.

Khripounoff, A., Vangriesheim, A., Crassous, P. and Etoubleau, J., 2009, High frequency of sediment gravity flow events in the Var submarine canyon (Mediterranean Sea): Marine Geology, *v.263*(1-4), p.1-6.

Liu, J. T., Wang, Y. H., Yang, R. J., Hsu, R. T., Kao, S. J., Lin, H. L., & Kuo, F. H., 2012, Cyclone-induced hyperpycnal turbidity currents in a submarine canyon: Journal of Geophysical Research: Oceans, v. 117, no. C04033.

Paull, C.K., Talling, P.J., Maier, K.L., Parsons, D., Xu, J., Caress, D.W., Gwiazda, R., Lundsten, E.M., Anderson, K., Barry, J.P. and Chaffey, M., 2018, Powerful turbidity currents driven by dense basal layers: Nature communications, v. 9(1), p. 4114.

Palanques, A., Martín, J., Puig, P., Guillén, J. and Sardà, F., 2006, Evidence of sediment gravity flows induced by trawling in the Palamós (Fonera) submarine canyon (northwestern Mediterranean): Deep Sea Research Part I: Oceanographic Research Papers, v. 53(2), p.201-214.

Puig, P., Canals, M., Company, J.B., Martín, J., Amblas, D., Lastras, G., Palanques, A. and Calafat, A.M., 2012, Ploughing the deep sea floor: Nature, v. 489(7415), p.286.

Xu, J. P., Noble, M. A., & Rosenfeld, L. K., 2004, In-situ measurements of velocity structure within turbidity currents: Geophysical Research Letters, no. 31(9).

Xu, J. P. (2010). Normalized velocity profiles of field-measured turbidity currents. *Geology*, *38*(6), 563-566.

Zhang, Y., Liu, Z., Zhao, Y., Colin, C., Zhang, X., Wang, M., Zhao, S. and Kneller, B., 2018. Long-term in situ observations on typhoon-triggered turbidity currents in the deep sea: *Geology*, v. 46, p. 675–678

Table DR3: Sustained deep-ocean contour currents (velocity estimated at benthic boundary layer) measured by current meters.

Location (Water depth)	**Velocity [measured or estimated at benthic boundary layer]**	**Reference**
Western Rockall Trough (1.1-3.6 km)	0.06 – 0.15 m/s	McCave et al. (2017)
NE Atlantic (1.2 km)	0.11 m/s	McCave et al. (2017)
South of Iceland (1.0-2.3 km)	0.09- 0.15 m/s	McCave et al. (2017)
Weddell Sea (3.7-4.5 km)	0.03-0.10 m/s	McCave et al. (2017)
Scotia Sea (2.9-3.3 km)	0.07-0.10 m/s	McCave et al. (2017)
Barents Sea (2.7-4.1 km)	0.10 m/s	McCave et al. a(2017)
NW Mediterranean Sea (1.0-2.5 km)	0.05-0.25 m/s	Miramontes et al. a (2019)
Mozambique Channel (3.4-4.05 km)	0.09-0.53 m/s	Miramontes et al. b (2019)
Mozambique Channel (1.2-2.8 km)	<0.50 m/s	Ridderinkhof et al. (2010)

REFERENCES

McCave, I. N., Thornalley, D. J. R., & Hall, I. R., 2017, Relation of sortable silt grain-size to deep-sea current speeds: Calibration of the 'Mud Current Meter'. Deep Sea Research Part I: Oceanographic Research Papers, v. 127, p. 1-12.

Miramontes, E., Garreau, P., Caillaud, M., Jouet, G., Hernandez-Molina, J., Clare, M., Cattaneo, A., 2019; Contourite distribution and bottom currents in the NW Mediterranean Sea: Coupling seafloor geomorphology and hydrodynamic modelling, Geomorphology v.333, p. 43-60.

Miramontes, E., Penven, P., Fierens, R., Droz, L., Toucanne, S., Jorry, S.J., Jouet, G., Pastor, L., Silva Jacinto, R., Gaillot, A., Giraudeau, J. and Raisson, F., 2019; The influence of bottom currents on the Zambezi Valley morphology (Mozambique Channel, SW Indian Ocean): In situ current observations and hydrodynamic modelling. *Mar. Geol.*, v. 410, p. 42–55.

Ridderinkhof, H., Van der Werf, P. M., Ullgren, J. E., Van Aken, H. M., Van Leeuwen, P. J., and De Ruijter, W. P. M., 2010, Seasonal and interannual variability in the Mozambique Channel from moored current observations: Journal of Geophysical Research: Oceans, no. *115*(C6).