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## SUPPLEMENTARY MATERIAL

**A meta-study of relationships between fluvial channel-body stacking pattern and aggradation rate: implications for sequence stratigraphy**

Luca Colombera*, Nigel P. Mountney, William D. McCaffrey

*l.colombera@leeds.ac.uk

## Overview of FAKTS database

The Fluvial Architecture Knowledge Transfer System (FAKTS) is a database that contains field- and literature-derived quantitative and qualitative data relating to the sedimentary architecture of ancient successions and modern rivers.

FAKTS is a relational database: it stores all information in tables organized in such way that they account for the existence of different geologic entities and their relationships. FAKTS is fundamentally object oriented, in the sense that it considers the sedimentary architecture of fluvial depositional systems as made of discrete building blocks (genetic units), each of which is assigned a row in a given table. Each genetic unit belongs to a stratigraphic volume called a *subset*; each subset is a portion of the total dataset characterized by given attribute values, such as system controls (e.g. aggradation rate, basin climate type) and descriptive parameters (e.g. river pattern, distality relative to other subsets). By breaking down depositional systems into subsets, FAKTS allows for the investigation of the spatial and temporal evolution of those systems. For each case study, FAKTS also stores metadata describing, for example, the methods by which data were acquired, the chronostratigraphy of the study interval and the geographic location. A threefold data-quality ranking system is also implemented with the purpose of rating datasets and genetic units.

Genetic units included in the database belong to three hierarchies of observation: *depositional elements*, *architectural elements* and *facies units*, in order of decreasing scale. The geometry of the genetic units is characterized by parameters describing their size in the vertical, cross-gradient and down-gradient directions (thickness, width and dip length). Widths and lengths are classified according to the completeness of observations into complete, partial or unlimited categories. Partial sizes refer to measurements of units for which one lateral termination is not exposed (e.g. outcrop termination), whereas unlimited sizes refer to bodies for which both lateral terminations are not exposed. Apparent widths are stored whenever only oblique observations with respect to paleoflow are available. The relationships between genetic units are stored by digitizing (i) the containment of each unit within its higher-scale parent entity (e.g. architectural elements within depositional elements; depositional elements within subsets) and (ii) the spatial relationships between units at the same scale, which are digitized as transitions in the vertical, cross-gradient and downstream directions. Additional attributes are defined to improve the description of specific units (e.g. sinuosity value, grain-size distributions of facies units), whereas accessory information (e.g. pedological characters) can also be stored for every unit within open fields. For some subsets, FAKTS also stores statistical parameters referring to genetic-unit types, as literature data are often presented in this form.

For the purpose of this work, the main focus is on the recognition, subdivision and classification of large-scale depositional elements.

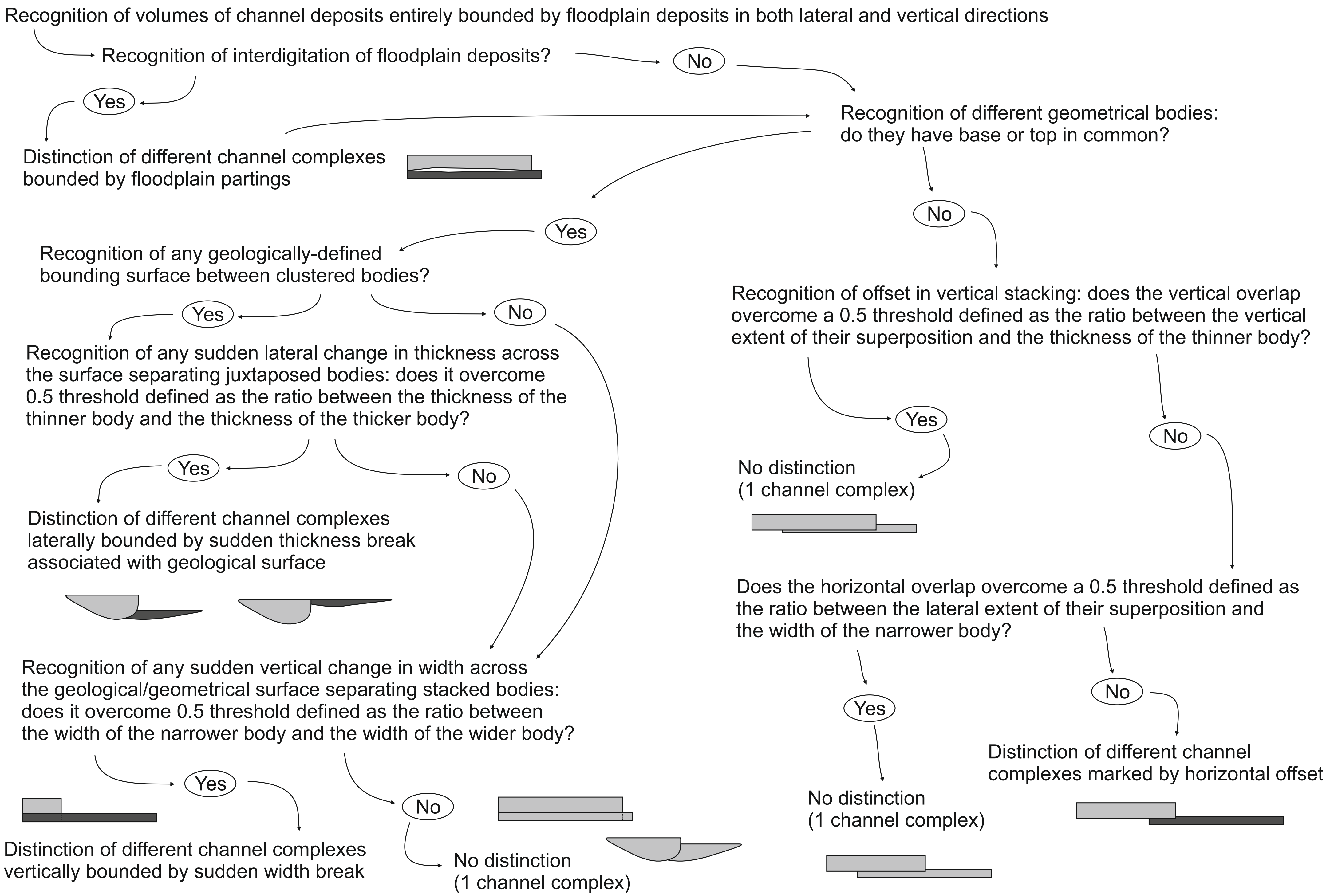
## Classification of depositional elements

The FAKTS approach to the segmentation of alluvial architecture at the largest scale involves identifying discrete channel bodies, and then dividing the remaining non-channelized floodplain background into discrete objects that are juxtaposed to the channel bodies in a spatially coherent way. Large-scale depositional elements are then classified as *channel-complexes* or *floodplain* elements on the basis of the origin of their deposits, and are distinguished on the basis of geometric rules (see guidelines in fig. DR1). The application of these rules can be flexible, as the criteria devised for the definition of these objects may sometimes be difficult to apply due to limitations determined by the possible lack of data of either a geometric or geologic nature (e.g. 3D channel-body geometries, recognizable internal bounding surfaces): such difficulties are recorded by meta-data attributes for data-ranking, data-type and target-scale definition. In addition, the geometric criteria cannot be followed altogether for cases where data are derived from published works presenting only summary results (e.g. data from plots of dimensional parameters of channelized bodies); this form of uncertainty is recorded by a data-ranking attribute.

Each stratigraphic volume that is characterized at the depositional-element scale is firstly segmented into channel-complexes; the set of geometric criteria given in the guidelines provided overleaf must be followed to distinguish individual units among channelized deposits that are complexly juxtaposed or interfingered with floodplain deposits. Such criteria consider geometric change across the vertical extension of channel-body clusters, taking into account the interdigitation of floodplain deposits, mode and rate of change in the lateral extension of contiguous channel deposits along the vertical direction, and existence of lateral offsets in vertically stacked channel-bodies. Whenever geologic knowledge permits the lateral tracing of important erosional surfaces, it is possible to adopt such surfaces as depositional-element bounding surfaces. Due to the way they are defined, channel complexes simply represent genetic bodies interpreted as having been deposited in a channelized context and encased by floodplain deposits: in geologic terms they could still span a wide range of hierarchical orders (e.g. distributary channel-fills, channel-belts, valley-fills); the chosen approach to their definition aims to minimize interpretation, thereby still ensuring the possibility for the analysis of channel clustering in different depositional settings.

The subdivision of floodplain elements is carried out subsequently to channel-complex assignment, such that the rest of the subset (stratigraphic volume) is broken down into packages of floodplain deposits that are referable as neighboring bodies to each channel-complex. Floodplain depositional elements simply represent geometric bodies interpreted as deposited in out-of-channel setting.

**Fig. DR 1 – GUIDELINES FOR THE GEOMETRICAL DEFINITION OF CHANNEL COMPLEXES (geologic criteria may also apply independently)**



**Tab. DR 1** – List of case studies considered and associated ancillary information.
Multiple values of aggradation rate are associated to some case studies: each entry refers to a stratigraphic volume, which are listed from the most ancient to the most recent for each succession.

| Case ID | Case study succession | Basin | Geographic location | Data types | Source | aggr. rate (mm/yr) |
|---|---|---|---|---|---|---|
| 3 | Po Basin Quaternary fill | Po Basin | N Italy, Po Plain | Cores,Well cuttings | Amorosi et al. (2008) Sed. Geol. 209, 58-68. | 0.45 |
| 28 | Caspe Fm. | Ebro Basin | NE Spain | Outcrops,Geoelectrical methods | Cuevas Martínez et al. (2010) Sedimentology 57, 162-189. | 0.16 |
| 51 | Olson Mb., Escanilla Fm. | Ainsa Basin | NE Spain, Central Pyrenees | Outcrops | Labourdette (2011) AAPG Bull. 95, 585-617. | 0.127 |
| 52 | Omingonde Fm. | Waterberg Basin | Central Namibia | Outcrops | Holzförster et al. (1999) J. Afr. Earth. Sci. 29, 105-123. | 0.017 |
| | | | | | | 0.043 |
| | | | | | | 0.027 |
| 66 | Muda Fm. | West Natuna Basin | South China Sea, Sunda Shelf | 3D seismics | Darmadi et al. (2007) J. Sed. Res. 77, 225-238. | 0.042 |
| 67 | Chinji Fm. | Himalayan Foredeep Basin | N Pakistan, Potwar Plateau | Outcrops | McRae (1990) Jour. Geol. 98, 433-456. | 0.195 |
| | | | | | | 0.16 |
| | | | | | | 0.148 |
| 68 | Chinji Fm. | Himalayan Foredeep Basin | N Pakistan, Potwar Plateau | Outcrops | Friend et al. (2001) J. Geol. Soc. 158, 163-177. | 0.165 |
| 69 | Price River Fm. | Western Interior Basin | USA, Utah | Outcrops | Olsen (1995) NPF Spec. Publ. 5, 75-96. | 0.065 |
| 69 | North Horn Fm. | Western Interior Basin | USA, Utah | Outcrops | Olsen (1995) NPF Spec. Publ. 5, 75-96. | 0.027 |
| 70 | Durham Coal Measures | Pennine Basin | England, County Durham | Outcrops,Well logs | Fielding (1986) Sedimentology 33, 119-140. | 0.15 |
| 78 | Distal Tortola fluvial system Upper Unit | Loranca Basin | Central Spain | Outcrops | Martinius & Nieuwenhuijs (1995) Pet. Geosc. 1, 237-252. | 0.1 |
| 79 | Medial Tortola fluvial system Upper Unit | Loranca Basin | Central Spain | Outcrops | Martinius (2000) J. Sed. Res. 70, 850-867. | 0.069 |
| 80 | Joggins Fm. | Cumberland Basin | E Canada, Nova Scotia | Outcrops | Rygel & Gibling (2006) J. Sed. Res. 76, 1230-1251. | 0.92 |
| 109 | Kaiparowits Fm. | Kaiparowits Basin | USA, S Utah | Outcrops | Roberts (2007) Sed. Geol. 197, 207-233. | 0.41 |
| 113 | Ferris Fm. | Hanna Basin | USA, S Wyoming | Outcrops,Airborne images | Hajek et al. (2010) Geology 38, 535-538. | 0.115 |
| 115 | Blackhawk Fm. | Western Interior Basin | USA, central Utah | Outcrops | Hampson et al. (2012) Sedimentology 59, 2226-2258. | 0.088 |
| | | | | | | 0.17 |
| | | | | | | 0.673 |
| | | | | | | 0.226 |
| 117 | Sariñena Fm. | Ebro Basin | NE Spain | Outcrops | Hirst (1991) SEPM Concepts in Sed. and Paleo. 3, 111-121. | 0.09 |
| 121 | Chinle Fm. | Chinle Basin | USA, NE Arizona | Outcrops | Trendell et al. (2013) J. Sed. Res. 83, 873-895. | 0.038 |
| | | | | | | 0.009 |
| | | | | | | 0.013 |
| 123 | North Horn Fm. | Axhandle Basin | USA, Utah | Outcrops | Talling et al. (1995) GSA Bull. 107, 297-315. | 0.057 |
| | | | | | | 0.091 |
| | | | | | | 0.011 |
| | | | | | | 0.046 |
| | | | | | | 0.104 |
| | | | | | | 0.018 |
| | | | | | | 0.022 |
| | | | | | | 0.041 |
| 124 | Horseshoe Canyon Fm. | Alberta Basin | Canada, Alberta | Outcrops | Straight & Eberth (2002) Palaios 17, 472-490. | 0.07 |
| | | | | | | 0.083 |
| 125 | Körös Basin Quaternary fill | Körös Basin | SE Hungary | Cores,Well logs | Nádor & Zstanó (2011) SEPM Spec. Publ. 97, 375-392. | 0.198 |
| | | | | | | 0.159 |
| 126 | Judith River Fm. | Western Interior Basin | USA, N Montana | Outcrops | Rogers (1998) J. Sed. Res. 68, 615-631. | 0.021 |
| | | | | | | 0.131 |
| 127 | Castillo Fm. | San Jorge Basin | S Argentina, Patagonia | Outcrops | Paredes et al. (2007) Sed. Geol. 202, 96-123. | 0.053 |

**Tab. DR 2** – Information on types of chronologic/chronometric constraints on which the average aggradation rates were estimated for the case studies, reported for each stratigraphic volume.
The nature and magnitude of uncertainty in the computed aggradation rates depend on the type of constraints available, as related by this table. Chronometric ages, and magnetostratigraphic and biostratigraphic constraints are reported in the table only for cases where these are available in the study areas considered and have been employed. The next to last column reports on stratigraphic volumes whose age is partly constrained on correlation of surfaces outside the study areas. The references provided in the last column, together with works cited in the articles themselves, contain information on the constraints used for deriving the average aggradation rates, including information on the uncertainty associated with stratal correlation and radiometric dating.

| Case ID | Case study succession | Avg aggr. rate (mm/yr) | Radiometric age base | Radiometric age top | Magnetostratigraphy | Biostratigraphy | Correlation to dated surface | Reference (see cited article for information on age uncertainty) |
|---|---|---|---|---|---|---|---|---|
| 3 | Po Basin Quaternary fill | 0.45 | | | | | Yes | Muttoni et al. (2003) Geology 31, 989-992. |
| 28 | Caspe Fm. | 0.16 | | | Yes | | | Garcés et al. (2008) Earth Plan. Sci. Lett. 275, 181-186. |
| 51 | Olson Mb., Escanilla Fm. | 0.127 | | | Yes | | | Mochales et al. (2012) GSA Bull. 124, 1229-1250. |
| 52 | Omingonde Fm. | 0.017 | | | | | Yes | Zerfass et al. (2005) Gondw. Res. 8, 163-176. |
| 52 | Omingonde Fm. | 0.043 | | | | Yes | Yes | Smith & Swart (2002) Palaios 17, 249-267. |
| 52 | Omingonde Fm. | 0.027 | | | | Yes | Yes | Abdala et al. (2013) Gondw. Res. 23, 1151-1162. |
| 66 | Muda Fm. | 0.042 | | | | | Yes | Darmadi et al. (2007) J. Sed. Res. 77, 225-238. |
| 67 | Chinji Fm. | 0.195 | | | Yes | | | Johnson et al. (1985) Jour. Geol. 93, 27-40. |
| 67 | Chinji Fm. | 0.16 | | | Yes | | | Johnson et al. (1985) Jour. Geol. 93, 27-40. |
| 67 | Chinji Fm. | 0.148 | | | Yes | | | Johnson et al. (1985) Jour. Geol. 93, 27-40. |
| 68 | Chinji Fm. | 0.165 | | | Yes | | | Johnson et al. (1985) Jour. Geol. 93, 27-40. |
| 69 | Price River Fm. | 0.065 | | | | | Yes | Robinson & Slingerland (1998) Basin Res. 10, 109-127. |
| 69 | North Horn Fm. | 0.027 | | | | | Yes | Robinson & Slingerland (1998) Basin Res. 10, 109-127. |
| 70 | Durham Coal Measures | 0.15 | | | | | Yes | Hess & Lippolt (1986) Chem. Geol. (Isot. Geosc. Sect.) 59, 143-154. |
| 78 | Distal Tortola system, Upper Unit | 0.1 | | | | Yes | | Martinius (2000) J. Sed. Res. 70, 850-867. |
| 79 | Medial Tortola system, Upper Unit | 0.069 | | | | Yes | | Martinius (2000) J. Sed. Res. 70, 850-867. |
| 80 | Joggins Fm. | 0.92 | | | | Yes | | Utting et al. (2010) Palynology 34, 43-89. |
| 109 | Kaiparowits Fm. | 0.41 | 75.96 ± 0.14 Ma | 74.21 ± 0.18 Ma | | | | Roberts et al. (2005) Cret. Res. 26, 307-318. |
| 113 | Ferris Fm. | 0.115 | | | | Yes | | Wroblewski (2004) Palaios 19, 249-258. |
| 115 | Blackhawk Fm. | 0.088 | | | | | Yes | Krystinik & DeJarnett (1995) AAPG Mem. 64, 11-26. |
| 115 | Blackhawk Fm. | 0.17 | | | | | Yes | Krystinik & DeJarnett (1995) AAPG Mem. 64, 11-26. |
| 115 | Blackhawk Fm. | 0.673 | | | | | Yes | Krystinik & DeJarnett (1995) AAPG Mem. 64, 11-26. |
| 115 | Blackhawk Fm. | 0.226 | | | | | Yes | Krystinik & DeJarnett (1995) AAPG Mem. 64, 11-26. |
| 117 | Sariñena Fm. | 0.09 | | | Yes | | | Pérez-Rivarés et al. (2002) Rev. Soc. Geol. Esp. 15, 217-231. |
| 121 | Chinle Fm. | 0.038 | 225.2 ± 0.28 Ma | 223.0 ± 0.27 Ma | | | | Ramezani et al. (2011) GSA Bull. 123, 2142-2159. |
| 121 | Chinle Fm. | 0.009 | 223.0 ± 0.27 Ma | 219.3 ± 0.27 Ma | | | | Ramezani et al. (2011) GSA Bull. 123, 2142-2159. |
| 121 | Chinle Fm. | 0.013 | 219.3 ± 0.27 Ma | 218.0 ± 0.28 Ma | | | | Ramezani et al. (2011) GSA Bull. 123, 2142-2159. |
| 123 | North Horn Fm. | 0.057 | | | Yes | | | Talling et al. (1994) Jour. Geol. 102, 181-196. |
| 123 | North Horn Fm. | 0.091 | | | Yes | | | Talling et al. (1994) Jour. Geol. 102, 181-196. |
| 123 | North Horn Fm. | 0.011 | | | Yes | | | Talling et al. (1994) Jour. Geol. 102, 181-196. |
| 123 | North Horn Fm. | 0.046 | | | Yes | | | Talling et al. (1994) Jour. Geol. 102, 181-196. |
| 123 | North Horn Fm. | 0.104 | | | Yes | | | Talling et al. (1994) Jour. Geol. 102, 181-196. |
| 123 | North Horn Fm. | 0.018 | | | Yes | | | Talling et al. (1994) Jour. Geol. 102, 181-196. |
| 123 | North Horn Fm. | 0.022 | | | Yes | | | Talling et al. (1994) Jour. Geol. 102, 181-196. |
| 123 | North Horn Fm. | 0.041 | | | Yes | | | Talling et al. (1994) Jour. Geol. 102, 181-196. |
| 124 | Horseshoe Canyon Fm. | 0.07 | | | Yes | | | Lerbekmo & Braman (2005) Bull. Can. Petrol. Geol. 53, 154-164. |
| 124 | Horseshoe Canyon Fm. | 0.083 | | | Yes | | | Lerbekmo & Braman (2005) Bull. Can. Petrol. Geol. 53, 154-164. |
| 125 | Körös Basin Quaternary fill | 0.198 | | | Yes | | | Nádor et al. (2003) Quat. Sci. Rev. 22, 2157-2175. |
| 125 | Körös Basin Quaternary fill | 0.159 | | | Yes | | | Nádor et al. (2003) Quat. Sci. Rev. 22, 2157-2175. |
| 126 | Judith River Fm. | 0.021 | 79.6 ± 0.1 Ma | | | | Yes | Rogers (1998) J. Sed. Res. 68, 615-631. |
| 126 | Judith River Fm. | 0.131 | | 74.1 ± 0.7 Ma | | | Yes | Rogers (1998) J. Sed. Res. 68, 615-631. |
| 127 | Castillo Fm., Chubut Gp. | 0.053 | | | | | Yes | Suárez et al. (2014) J. South Am. Earth Sci. 50, 67-74. |

**Tab. DR 3** – Raw data on channel-complex proportion and mean aggradation rate as derived from FAKTS and represented in fig. 1. Pearson's correlation coefficient: R = -0.043.

| case ID | subset ID | Channel-complex proportion | mean aggradation rate (m/Ka) |
|---|---|---|---|
| 3 | 15 | 0.49 | 0.45 |
| 28 | 170 | 0.16 | 0.1545 |
| 52 | 385 | 0.30 | 0.017 |
| 52 | 386 | 0.51 | 0.043 |
| 52 | 387 | 0.17 | 0.027 |
| 67 | 560 | 0.32 | 0.195 |
| 67 | 561 | 0.17 | 0.16 |
| 67 | 562 | 0.37 | 0.148 |
| 69 | 566 | 0.53 | 0.065 |
| 69 | 570 | 0.26 | 0.027 |
| 78 | 630 | 0.21 | 0.1 |
| 79 | 632 | 0.30 | 0.069 |
| 109 | 741-743 | 0.41 | 0.41 |
| 113 | 753 | 0.29 | 0.115 |
| 115 | 756 | 0.14 | 0.088 |
| 115 | 764 | 0.17 | 0.17 |
| 115 | 772 | 0.27 | 0.673 |
| 115 | 779 | 0.23 | 0.226 |
| 117 | 786 | 0.27 | 0.09 |
| 121 | 840 | 0.39 | 0.038 |
| 121 | 848 | 0.61 | 0.009 |
| 121 | 850 | 0.39 | 0.013 |
| 123 | 858 | 0.64 | 0.057 |
| 123 | 862 | 0.46 | 0.091 |
| 123 | 866 | 0.51 | 0.011 |
| 123 | 875 | 0.21 | 0.046 |
| 123 | 880 | 0.37 | 0.104 |
| 123 | 883 | 0.18 | 0.018 |
| 123 | 887 | 0.23 | 0.022 |
| 123 | 892 | 0.22 | 0.041 |
| 124 | 895 | 0.20 | 0.07 |
| 124 | 896 | 0.23 | 0.083 |
| 125 | 902 | 0.34 | 0.198 |
| 125 | 903 | 0.45 | 0.159 |
| 126 | 904 | 0.57 | 0.021 |
| 126 | 905 | 0.38 | 0.131 |

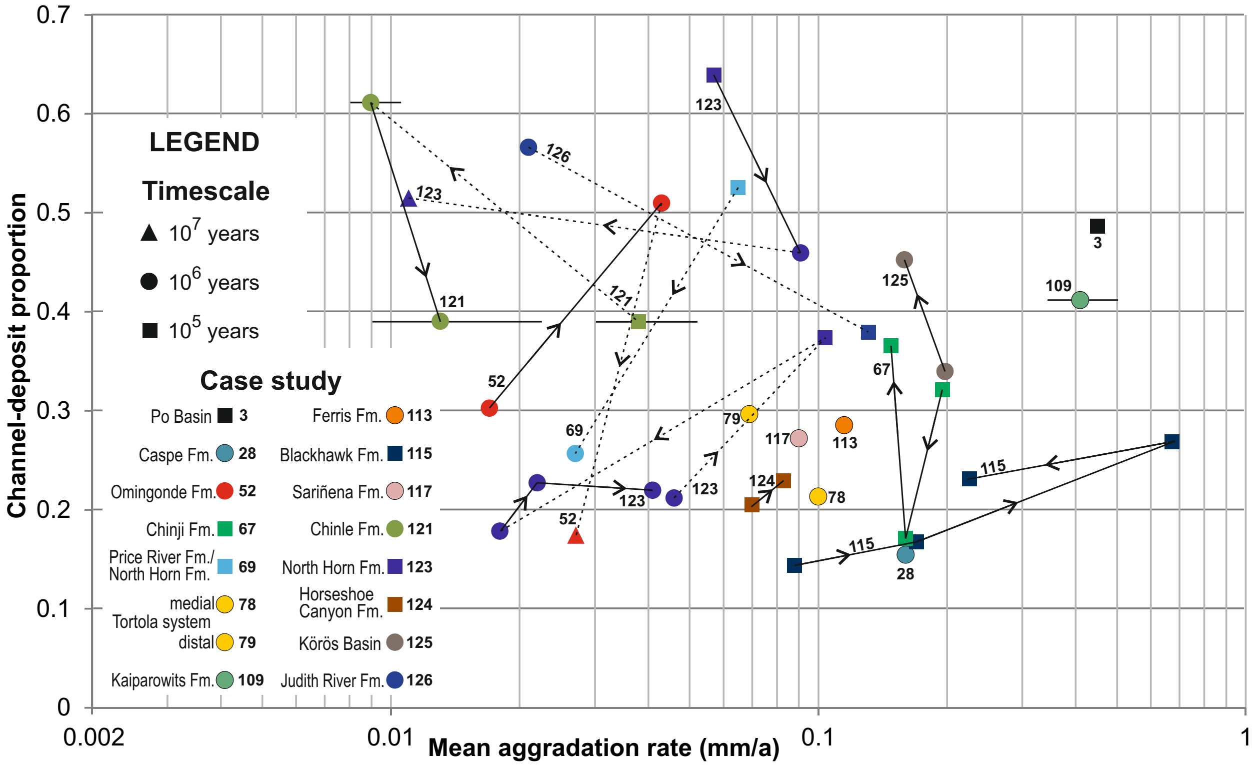



**Fig. DR 2** – Cross-plot of channel proportion and mean aggradation rate for different stratigraphic volumes. Each point represents a stratigraphic volume, and its shape indicates the timescale over which the aggradation rate was evaluated; the numeric labels denote the different FAKTS case-study successions used for this analysis. Data representing intervals from the same depositional system are joined by arrowed lines to indicate temporal evolution; each arrowed line represents a change (N = 18) and points stratigraphically up-section. Continuous lines represent changes over corresponding timescales or cases in which the largest aggradation rate value of the pair is estimated over a longer timescale; hatched lines represent changes for which the largest aggradation rate of the pair is estimated over a shorter timescale. Horizontal error bars are associated with datapoints representing stratigraphic volumes whose aggradation rates values where estimated from radiometric ages at their top and base.

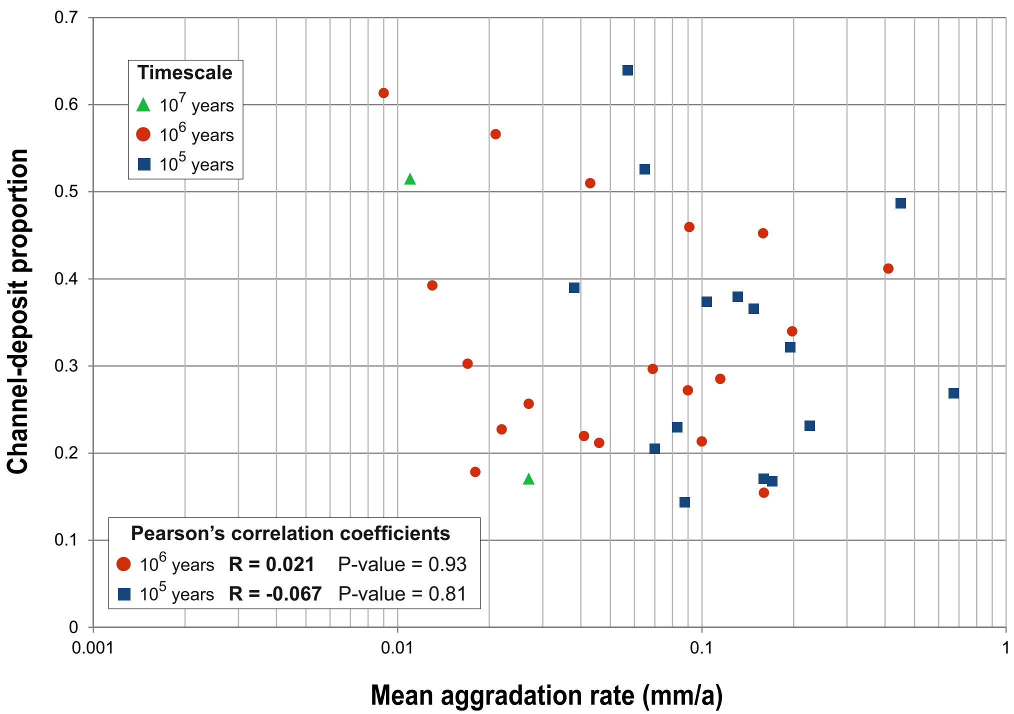



**Fig. DR 3** – Cross-plot of channel proportion and mean aggradation rate for different stratigraphic volumes. Each point represents a stratigraphic volume, and its shape and color indicates the timescale over which the aggradation rate was evaluated. Pearson's correlation coefficients are reported to quantify correlation between mean aggradation rate and channel-complex proportion, as separately evaluated for the $10^5$ yr and $10^6$ yr timescales.

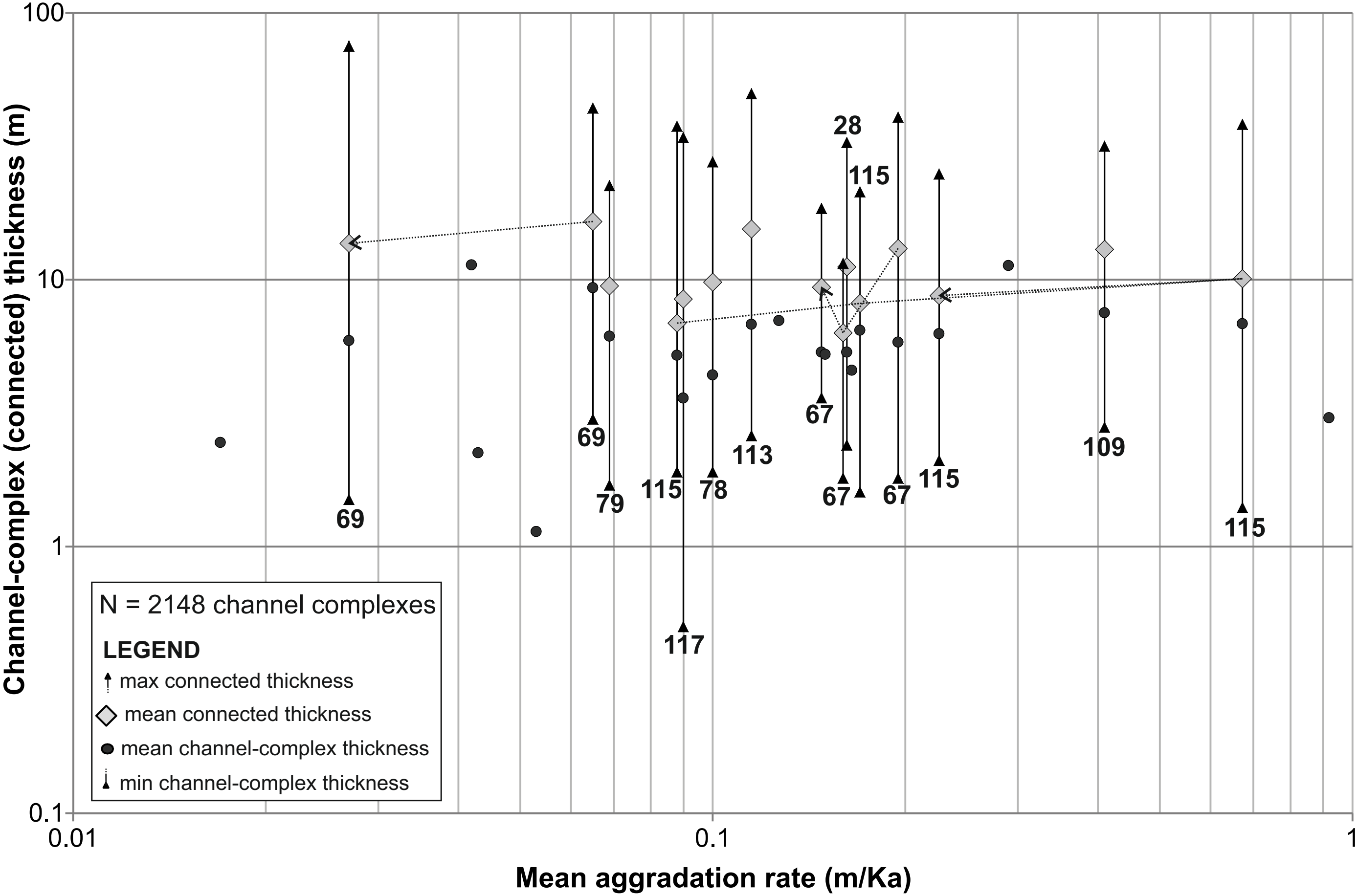



**Fig. DR 4** – Cross-plots of minimum and mean channel-complex thickness and mean and maximum channel-complex 'connected' thickness against mean aggradation rate for different stratigraphic volumes. Values of mean connected thickness from the same depositional system are joined by arrowed lines that indicate temporal evolution, pointing in the stratigraphic up-section direction.

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