http://journal.uir.ac.id/index.php/JGEET

E-ISSN : 2541-5794
P-ISSN : 2503-216X

Journal of Geoscience,
Engineering, Environment, and Technology
Vol 11 No 1 2026

RESEARCH ARTICLE

Architectural Element Analysis of Channel Deposits in The Cipamingkis River Section, Jatiluhur Formation

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Received: Aug 28, 2025; Accepted: Mar 13, 2026.
DOI: 10.25299/jgeet.2026.11.1.24766

Abstract

Architectural element analysis on the channel has been held with the length of the object study more than 3 kilometers in the Cipamingkis River Jatiluhur Formation. The channel deposit and association of the channel are generally influenced by the turbidity system in the slope setting. The determination of architectural elements in this study must consider the stratigraphic record, characterized by facies, facies association, internal geometry, and bounding surface. The study area has seven lithofacies and must be grouped into three facies associations. Channel elements are generally filled with coarse-grained sediment material and show amalgamation, thickened beds, and gradation of sandstone. There is fine-grained material that was found, such as siltstone, which indicates a levee element that has an older stratigraphic position than the channel element. Four-channel elements can be distinguished based on the characteristics of the constituent materials and their internal geometry. The vertical stack creates a channel complex in the study area, with channel element evolution starting from incision, and the last phase is aggradation-migration.

Keywords: Jatiluhur, Slope, Channel, Facies, Architectural, Elements

1. Introduction

1.1 Sub Introduction

Research on architectural elements in terrestrial (fluvial) environments was published earlier and subsequently became a reference for applications in marine environments (Miall, 1985). In fluvial sedimentology, the analysis of architectural elements is characterized by the interpretation of facies associations and the three-dimensional geometry of outcrops.

One concept of architectural element analysis serves as a useful tool for describing depositional units and modelling ancient channel deposits (Friend, 1983; Miall, 1985). Geological studies on the Jatihur Formation, particularly along the Cipamingkis River section, have been extensively conducted by several researchers (Abbdurokhim, 2014; Nurani, 2010); however, research focusing on architectural elements remains scarce. This study specifically examines the sandstone member, which is indicated as channel deposits, with an emphasis on discussing architectural elements and their evolution.

1.2 Studied Area

The research area is administratively located in Jonggol District, Bogor Regency, West Java Province, Indonesia.

2. Methods

The data used in this study were obtained from outcrops along the Cipamingkis River section, using the stratigraphic measured section method. The study area was divided into four traverse segments (Fig. 1), considering the relative ages of the outcrops. The age data refer to the publication by Nurani (2010). To characterize the architectural elements, several methods were applied, including lithofacies analysis, facies association analysis, and bounding surface, to support the research objectives.

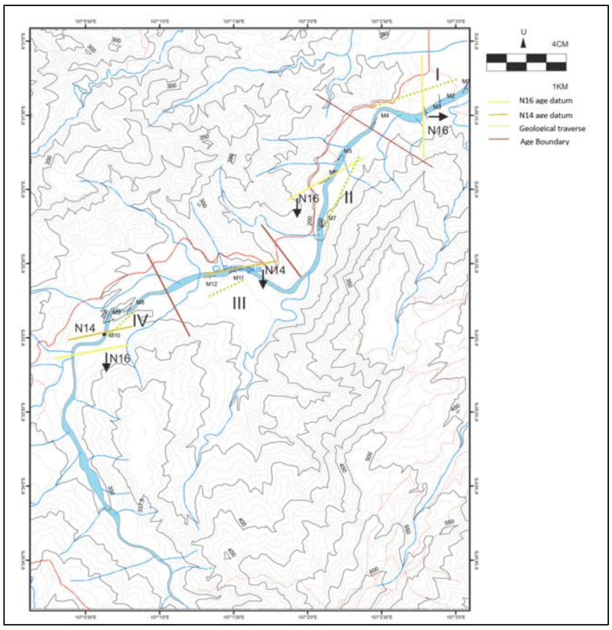

Fig. 1. Studied Area

3. Result and Discussion

3.1 Regional Stratigraphy

The Jatiluhur Formation represents the oldest rock unit exposed in the northern part of the Bogor Basin. This formation has a relatively wide distribution, cropping out from Purwakarta in the east to the Bogor area in the west (Sudjatmiko and Effendi, 1998). The Jatiluhur Formation is well exposed along the Cipamingkis River section. Abdurrokhim (2014) divided the Jatiluhur Formation into three parts: lower, middle, and upper. The lower part consists of slope deposits and channel deposits, dominated by siltstone with thick layers of fine-grained sandstone. The middle part is composed of sandy siltstone, thin sandstone layers, and thick limestone beds, with the limestone showing a thickening- and shallowing-upward trend. The upper part contains transgressive deposits characterized by interbedded limestone and sandstone. The exposed rocks of the Jatiluhur Formation are interpreted to range in age from N12 to N16 and are classified as third-order sequences.

3.2 Facies and Facies Association

The study area is divided into seven lithofacies, classified based on rock descriptions including color, thickness, distribution, sedimentary structures, and sedimentary textures such as grain size, shape, and sorting (Fig. 2). These characteristics were identified through outcrop observations and hand specimens collected during fieldwork. Layers, sedimentary units, and sedimentary structure components are fundamental aspects of observation that form the basis for lithofacies classification. The characteristics of each facies are presented in Table 1 below.

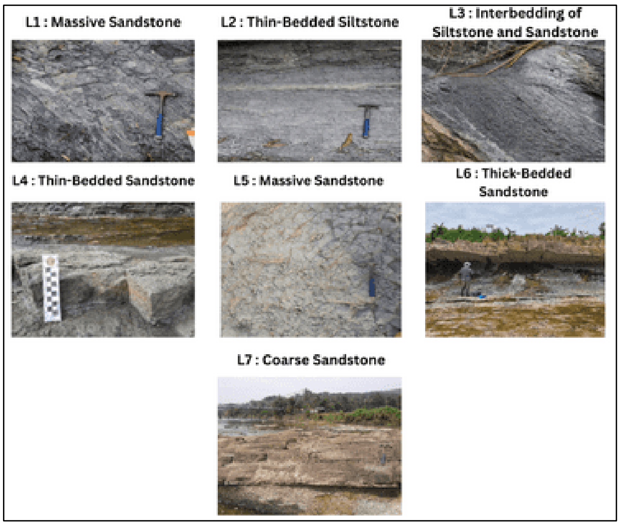

Fig. 2. Lithofacies identified in the study area consist of (L1) Massive Siltstone, (L2) Thin-Bedded Siltstone, (L3) Interbedding of Siltstone and Sandstone, (L4) Thin-Bedded Sandstone, (L5) Massive Sandstone, (L6) Thick-Bedded Sandstone, and (L7) Coarse Sandstone.

Table 1. Facies and Facies Associations

Facies Association	Facies	Dominant Grain Size	Sedimentary Structure	Turbidite Division	Bounding Surface	Thickness	Depositional Process
Muddy Turbidite	L1	Silt	Structureless	Td (Bouma, 1962), Facies F (Mutti, 1972)	Gradational	0.32 – 2.3 meters	Suspension fallout (low regime), low-density turbidity current
Channel Margin and Levee	L2	Silt with sand fragments	Parallel Lamination	Td (Bouma, 1962), Facies E (Mutti, 1972)	Erosional	Bed: 2 centimeters, Sediment Unit 2	Suspension fallout, low-density turbidity current (low velocity)
	L3	Silt, commonly interbedded with very fine sand	Parallel Lamination	Tc–Td (Bouma, 1962), Facies E (Mutti, 1972)	Concave and Gradational	Bed: 2.5 centimeters, Sediment up to 3 meters	Settling, low-density turbidity current, distal turbidite
	L4	Very fine to fine sand	Planar bedding, cross lamination, parallel lamination	Tc–Td (Bouma, 1962), Facies D (Mutti, 1972)	Erosional, Gradational	Bed: 9 centimeters, Sediment unit 2.3 meters	Sediment traction and mixed suspension, low-density turbidity current
Channel Axis	L5	Very fine to fine sand	Structureless	Ta (Bouma, 1962), Facies C (Mutti, 1972)	Erosional, Gradational	Bed: 8 centimeters, Sediment Unit 1.3 meters	Rapid fallout, Suspension, high-density turbidity current
	L6	Very fine to fine sand	Current ripple, flute cast, hummocky cross lamination, amalgamation	Tb (Bouma, 1962), S1 (Lowe, 1982), Facies C (Mutti, 1972)	Sharp Basal Contact	Bed: 18 centimeters up to 1.7 meters	Rapid suspension sedimentation, high-density turbidity current
	L7	Medium to coarse sand	Current ripple, trough cross lamination	Ta, Tb, Tac (Bouma, 1962), Vertical Sequence (Lowe, 1982), Facies B (Mutti, 1972)	Erosional, Sharp Basal Contact	Bed: 27 centimeters, Sediment up to 2.5 meters	Turbidity current with medium to high density

After observing the lithofacies, the facies were grouped. Looking at the characteristics and physical properties of the rocks in the study area, such as the presence of interlayers or heterolithic sediments associated with very fine grain sizes, this indicates a decrease in transport energy. The presence of carbonate sandstone with medium to coarse grain sizes and thick layers indicates high deposition of energy in turbidity currents. These indications are often found in deep water channels, such as the model proposed by the author, which forms the basis for the classification used in grouping facies. In general, facies associations in the study area are divided into three (Fig. 3) with the following explanations: facies.

3.2.1 Association 1: Muddy Turbidite Fill

In this facies association, the lithology consists of mudstone to claystone (L1), interpreted as very fine and massive sedimentary material deposited as suspended material settled in the water column. Muddy turbidite fill is a material commonly found in the lower parts of basin plains, intraslope depressions, and interchannel areas (Stow and Piper, 1984). The deposition of this fine-grained material originates from suspension fallout or from dilute turbidite flows moving toward channels from other sources (Alpak and Barton, 2013). Benthic foraminifera are present in the mudstone layer, indicating that this facies association indicates sedimentation processes occurring in a bathyal environment (Nurani, 2010) and also developed as hemipelagite or may have formed due to turbiditic siltstone.

3.2.2 Facies Association 2: Channel Margin and Levee

The channel margin is the channel feature that occupies the boundary of the channel itself, with a morphology that tends to be shallower than the channel axis. Deposits from the channel margin generally have lithological characteristics composed of finer-grained sediments and relatively thinner layer thickness intervals (Covault et al., 2016). The processes affecting this channel section have lower energy levels. This facies association consists of lithofacies 2, lithofacies 3, and lithofacies 4. These three lithofacies exhibit distinctive characteristics dominated by very fine grains and relatively thinner layer thicknesses, typical of channel margins. Fine heterolithic sediments are also present, and soft sediment deformation can sometimes be found due to the slopes on the edges becoming steeper than those on the channel axis. This facies association is influenced by low energy, and turbidite deposits are produced by low-density turbidite currents, with energy decreasing on the channel edges, leading to sediment accumulation on the channel margin dominated by very fine grain sizes. Channel margins can also be classified as internal levees (Kane and Hodgson, 2011), inner levees (Deptuck et al., 2003; Jobe et al., 2015), or even as overbank deposits.

3.2.3 Facies Association 3: Channel Axis

The channel axis tends to have relatively coarse sedimentary rock fillings and relatively thick intervals with sedimentary structures such as parallel lamination, cross lamination, and current ripples. These characteristics and patterns indicate deposits from the channel axis because this part of the channel axis is the deepest part of a channel, where processes that approach and allow deposits to form in that location are influenced by higher energy and greater force compared to processes in other parts of the channel. This facies association consists of lithofacies 7, lithofacies 6, and lithofacies 5. These three lithofacies have distinctive characteristics, namely relatively thick thickness, dominated by coarser grain sizes, and the presence of various structures and basal surfaces that generally have distinct and erosional forms interpreted as channel axis characteristics. In this facies association, turbidite deposits dominate, with their mechanisms influenced by high-density, high-energy turbidite currents.

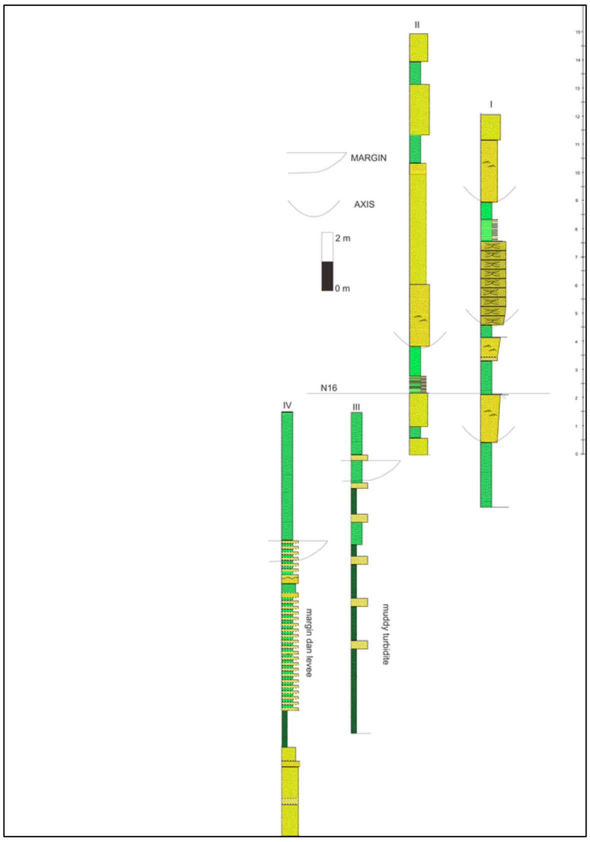

Fig. 3. Facies Associations Present in the log

3.3 Architectural Element

Architectural element observation is conducted in a stepwise manner from the smallest order to the largest order. In this analysis, we refer to the classification (Mayall et al., 2002; Sprague, 2002) that divides architectural element observation into five orders. In the first order, analysis is conducted through lithofacies identification, while in the second order, analysis is conducted through facies association identification. At the third order, the architectural elements are identified, while at the fourth order, the stratigraphic architecture and evolution of the channel elements are determined. In the Jatiluhur Formation, the Cipamingkis River channel is characterized as a channel form, with a relatively erosional lower contact and relatively thick deposits present in the central or axial part. The sedimentary material filling the channel elements in the study area is dominated by thick sandstone layers and amalgamation (FA3) in the central or axis section, laterally transitioning into thin sandstone layers (L4). The edges of the channel elements are filled with interbedded sedimentary material with finer grain sizes. The study area is divided into four channel elements (Fig. 4).

3.3.1 Channel Element 1 (CH1)

Well exposed at (M4), it has a lenticular geometry with an erosional lower contact, with a maximum thickness of 1.7 meters at the axis and 15 centimeters at the edges, and a lateral width of 225 meters. Thinning of rock thickness in the northeast indicates that this area is a marginal zone. The lower contact with massive sandstone material (L1) has an average thickness of 1 meter, and the upper contact is not well exposed due to high erosion. The axis section consists of thick, amalgamated sandstone with cross-lamination structures (L6) in the southwestern part of the layer, while the edge or margin section toward the northeast shows layer thinning and contains thin sandstone material (L4). The axis section of this element is dominated by amalgamated sandstone whose deposition is influenced by turbidite currents (Lowe, 1982).

3.3.2 Channel Element 2 (CH2)

Well exposed at (M6), showing a lenticular geometry with erosional bottom contact, with a maximum exposed thickness of 2. 2 meters on the relatively southwest axis of the outcrop, which consists of an amalgamation of fine sandstone with cross-laminated sedimentary structures and, at the edge or margin, a layer up to 9 centimeter thick with a relative northeast direction. Lateral thinning is observed in the outcrop, indicating that the channel edge is relatively northeast. The lateral width reaches 300 meters with an erosional lower contact associated with sandstone interbedding. Similar to CH1, the deposition of this element is influenced by turbidity currents, with the observation of structureless sandstone in the uppermost layer and upward smoothing (S3/Ta division Lowe, 1982), indicating that this element is influenced by high-density turbidity currents during rapid sedimentation and turbulence damping (Cantero et al., 2012).

3.3.3 Channel Element 3 (CH3)

Well exposed at (M2), it has a lenticular geometry with medium to coarse sandstone layers (L7) of average thickness ranging from 33 centimeters to 3.5 meters within the layer package. The pattern coarsens upward, with the lower part showing cross-trough lamination sedimentary structures. The upward coarsening pattern (inverse grading) of the channel element, with coarse sandstone fill material, is influenced by traction carpets (Lowe, 1982). The lower contact is erosional, filled with finer material, namely siltstone.

3.3.4 Channel Element 4 (CH4)

Well exposed at (M1), which is the youngest channel deposit with a thickness of 220 centimeters at the axis and 370 meters laterally. Toward the southwest, the layer thins to 33 centimeters at the edge, interpreted as the channel margin. The sedimentary fill material consists of thick sandstone or amalgamation (L6). The lower contact is erosional to distinct in some places, with the lower part of the contact with slump or pelagic deposits of sandstone, while the upper part of the contact has thin medium sandstone layers (L4). Interpreted as deposits with high turbidity current concentrations, the presence of a thin sandstone layer (Tb Bouma Division) at the top of this element indicates the presence of traction currents under conditions of bed aggradation (Arnott and Hand, 1989). Similar to amalgamation, sandstone sequences in older channel systems are common and are typically referred to as turbidity channel fills. The Levee Element is observed in (M9) with fill material consisting of an alternation of sandstone and mudstone, with individual layer thicknesses of 4 to 6 centimeters, while the layer sequence reaches 7.5 meters. Levee elements are associated with thick layers of fine sandstone at the upper contact of the gradational layer. Levee elements are generally found in the southern part, which is dominated by alternating layers of siltstone and sandstone. It is interpreted that this element formed in the outside channel belt and exhibits lateral variations in thickness and deformation, characterized by slumping directed toward the channel belt (Kane and Hodgson, 2011). The levee element developed at a relatively older stratigraphic position than the channel element. Deposition in this element is indicated to have occurred before the channel system formed, during the incision or erosional phase. Interchannel: The lithology filling the interchannel is massive sandstone and claystone (L1), typically found at the lowest or oldest stratigraphic position compared to channel deposits. At some observation points, the presence of nodules and benthic foraminifera fossils is noted. In this area, clay and sandstone materials.

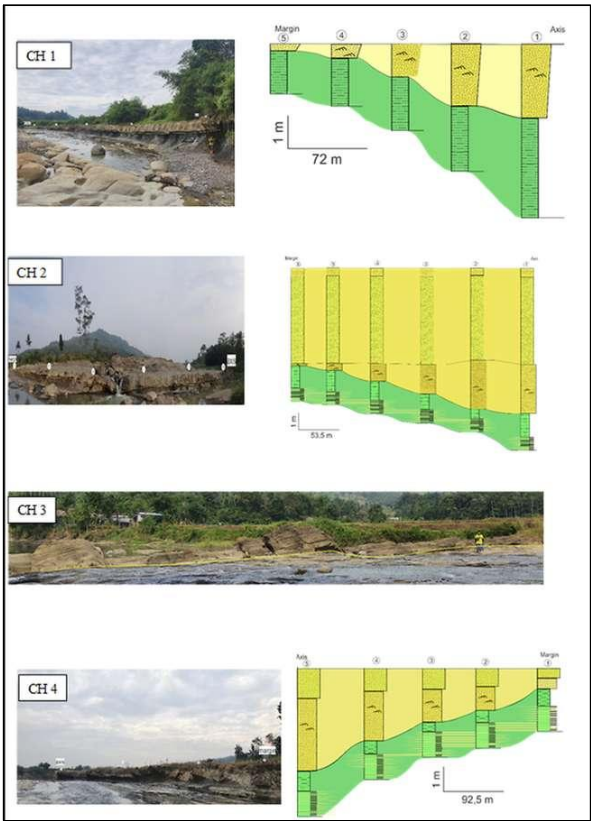

Fig. 4. Channel Element

3.4 Channel Complex

The channel complex represents a fourth-order architectural element, composed of multiple channel elements that are amalgamated according to stacking patterns, consistent sedimentary processes, and stratigraphic associations (Sprague, 2002; McHargue et al., 2011). In the study area, a single-channel complex is identified, consisting of four distinct channel elements. The internal relationships among these elements exhibit a vertical stacking architecture, arranged sequentially from the oldest (CH1) through CH2, CH3, and CH4. The amalgamation of these channel elements results in a composite channel complex with a cumulative thickness of approximately 16 meters, interpreted as deep-water slope channel-fill deposits.

In addition to channel elements, levee and interchannel deposits are also recognized, which predate the channelized deposits. These facies are dominated by finer-grained sediments compared to the channel fills, indicating that the study area initially developed within a levee depositional system prior to the transition into confined channel deposition. Levee elements typically occur in the transitional zone adjacent to channel margins, whereas interchannel deposits, subsequently overlain by channel-fill successions, developed under comparable depositional settings and paleogeographic controls.

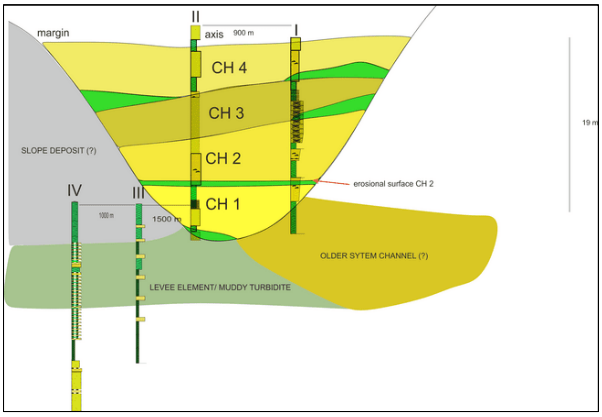

Fig. 5. Channel Complex

3.5 Channel Evolution

Formation along the Cipamingkis River is interpreted as an individual slope channel-fill deposit. Prior to the development of the slope channel, the study area was characterized by sediment bypass or levee depositional environments, with fine-grained muddy turbidite deposits, accompanied by levee elements that generally extended distally within an upper slope setting. These processes were influenced by sediment settling and lateral transport from confined channelized areas under low-energy and low-current conditions (Sprague, 2005). At this stage, no channel system had yet formed, but incision occurred, creating surface depressions on the slope with channel-like morphology.

The subsequent phase represents both erosional and depositional processes. Although sediment bypass was still present, it became less dominant. Deposition of finer-grained levee elements decreased, and channel deposition began during this stage, marked by the occurrence of channel elements (CH1 and CH2). These consist of thick, amalgamated sandstone beds (Bouma divisions Ta–Tab) deposited by low-energy, high-density turbidity currents, resting erosively on underlying siltstone. This indicates a transitional phase, followed by the shift from sediment bypass toward fully channel-dominated deposition. This change was likely triggered by reduced current energy or an increase in sand relative to clay within the flow (Schwarz and Arnott, 2007).

The backfilling phase followed, during which the channel was infilled with coarser-grained sandstone (CH3), deposited under high-density turbidity currents through traction carpet processes. Its association with siltstone lenses indicates a diversity of depositional processes (Abdurrokhim, 2013). This was succeeded by a reactivation phase, where massive siltstone deposits eroded underlying layers, a process recognized as reincision.

Channel aggradation and migration processes were actively involved in the deposition of CH4, which is associated with inner levee elements. This stage is characterized by erosional basal contacts with siltstone and the presence of thick, amalgamated sandstone beds deposited by high-density turbidity currents. The final stage is interpreted as channel abandonment, during which the channel was filled with very fine-grained material, such as clay and silt, although the complete abandonment facies of the channel complex was not clearly observed in the study area.

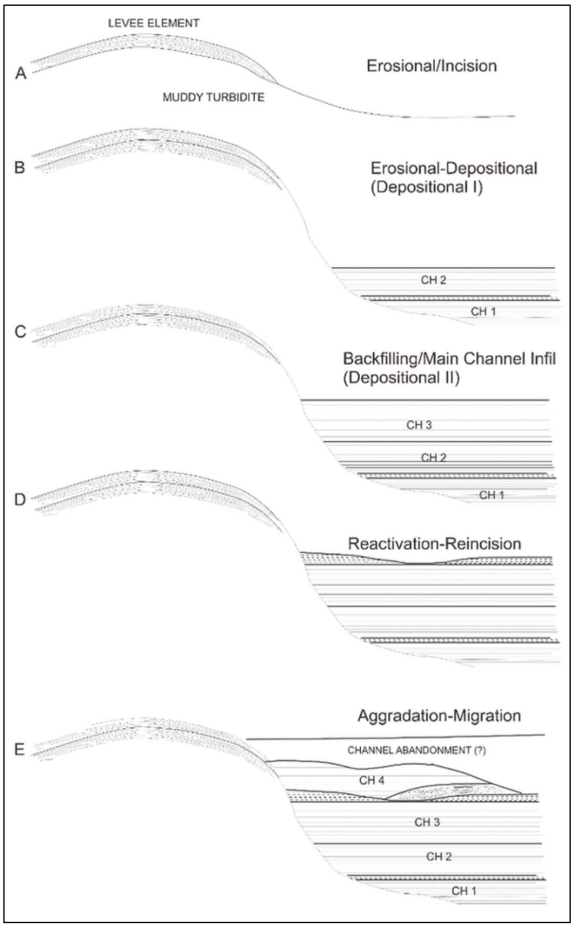

Fig. 6. Channel Evolution

4. Conclusion

The study area belongs to the Jatiluhur Formation, which is subdivided into seven lithofacies: massive siltstone, thinly bedded siltstone, interbedded siltstone with sandstone, thin-bedded sandstone, massive sandstone, thick-bedded sandstone, and coarse-grained sandstone. These seven lithofacies are grouped into three facies associations: Channel Axis, Channel Margin, and Bathypelagic. The Channel Axis is dominated by coarse-grained and thick-bedded deposits, occupying the deepest channel morphology. Its depositional mechanism is influenced by high-density, high-energy turbidity currents that transport relatively coarse materials. The Channel Margin and levee deposits consist of finer-grained and relatively thinner successions, deposited under lower-density, lower-energy turbidity currents, reflecting a progressive decrease in energy from the channel axis toward the channel margin. The Bathypelagic facies association comprises Lithofacies (L1), characterized by the finest-grained sediments deposited through settling and suspension fallout.

Four-channel elements were identified, exhibiting a vertically stacked architecture. From the oldest to the youngest: CH1 margin-oriented to the northeast, CH2 margin-oriented to the northeast—both deposited under the influence of high-energy turbidity currents and turbulence damping. CH3 was deposited under traction carpet processes, while CH4, the youngest channel, formed under traction currents associated with decreasing bed aggradation. Levee elements were also recognized in the study area, stratigraphically older than the channel elements. The channel complex in the study area is classified as an individual slope channel fill. Initial deposition was characterized by sediment bypass and levee element accumulation, representing an erosional phase or incision that formed channel depressions, followed by erosional–depositional processes, backfilling, and subsequent phases of reactivation and reincision. Aggradation and migration processes contributed to the redeposition of thick sandstone units and amalgamation (CH4). Finally, the abandonment phase marked the end of channel complex evolution, characterized by the deposition of silt and clay.

References

Abdurrokhim, Ito, M., 2013. The role of slump scars in slope channel initiation: A case study from the Miocene Jatiluhur Formation in the Bogor Trough, West Java, Journal of Asian Earth Sciences 71, 68-86. https://doi.org/10.1016/j.jseaes.2013.04.005

Aulia, I. & Aditiyo, R. (2021). Diagenesis study of Jatiluhur Formation at Cipamingkis River, Bogor Regency, West Java, Indonesia. Journal of Geoscience, Engineering, Environment and Technology, 6(4), pp.255–262. https://doi.org/10.25299/jgeet.2021.6.4.7646

Abdurrokhim, A., Adhiperdana, B. & Hendarmawan (2022). Temporal variation in sandstone composition of Miocene Jatiluhur Formation in the Bogor Trough, West Java, Indonesia. Journal of Geoscience, Engineering, Environment and Technology, 7(3), pp.132-139. https://doi.org/10.25299/jgeet.2022.7.3.9311

Abdurrokhim, 2014. A prograding slope-shelf succession of the middle-late Miocene Jatiluhur Formation: Sedimentology and genetic stratigraphy of mixed siliciclastic and carbonate deposits in the Logor Trough, West Java. Ph.D. Thesis, Chiba University, Japan.

Alpak, F.O., Barton, M.D., Naruk, S.J., 2013. The impact of fine-scale turbidite channel architecture on deep-water reservoir performance. Am Assoc Pet Geol Bull 97, 251–284. https://doi.org/10.1306/04021211067

Arnott, R.W.C., Hand, B.M., 1989. Bedforms, primary structures, and grain fabric in the presence of suspended sediment rain. Journal of Sedimentary Petrology, 59(6), 1062–1069.

Cantero, M.I., Cantelli, A., Pirmez, C., Balachandar, S., Mohrig, D., Hickson, T.A., Yeh, T.H., Naruse, H., Parker, G., 2012. Emplacement of massive turbidites linked to extinction of turbulence in turbidity currents. Nat Geosci 5, 42–45. https://doi.org/10.1038/ngeo1320

Cahyaningsih, C., Ritonga, A.L., Aldila, S. & Zulhikmah, Z. (2018). Lithofacies and depositional analysis environment of west section Kolok Nan Tuo village, Sawahlunto City, West of Sumatera. Journal of Geoscience, Engineering, Environment and Technology, 3(2), pp.128-133. https://doi.org/10.24273/jgeet.2018.3.2.340

Covault, J.A., Sylvester, Z., Hubbard, S.M., Jobe, Z.R., Sech, R.P., 2016. The Stratigraphic Record of Submarine-Channel Evolution. The Sedimentary Record 14, 4–11. https://doi.org/10.2110/sedred.2016.3

Deptuck, M.E., Steffens, G.S., Barton, M., Pirmez. C., 2003. Architecture And Evolution Of Upper Fan Channel-Belts On The Niger Delta Slope And In The Arabian Sea. Marine And Petroleum Geology 20(6-8), 649-676. https://doi.org/10.1016/j.marpetgeo.2003.01.004

Friend, P.F., 1983. Towards The Field Classification Of Alluvial Architecture Or Sequence. In: Collinson, JD, Lewin, J. (Eds.), Modern and Ancient Fluvial Systems. International Association of Sedimentologists, Special Publication 6, 345-354. https://doi.org/10.1002/9781444303773.ch28

Jobe, Z.R., Lowe, D.R., Morris, W.R., 2015. Climbing-ripple successions in turbidite systems: Depositional environments, process partitioning, and stratigraphic significance. Journal of Sedimentary Research 85(7), 879-894.

Khorniawan, W.B., Jayanti, A.G.R., & Caesario, D. (2024). Quantitative Analysis of Thin Section Using Frequency Measurement (Point Counting): Case Study on Limestone of The Rajamandala Formation, Cikamuning, West Java, Indonesia. Journal of Geoscience, Engineering, Environment, and Technology, 9(3), 251–258. https://doi.org/10.25299/jgeet.2024.9.3.16489

Kane, I.A., Hodgson, D.M., 2011. Sedimentological criteria to differentiate submarine channel levee subenvironments: Exhumed examples from the Rosario Fm. (Upper Cretaceous) of Baja California, Mexico, and the Fort Brown Fm. (Permian), Karoo Basin, S. Africa. Mar Pet Geol 28, 807–823. https://doi.org/10.1016/j.marpetgeo.2010.05.009

Lowe, D.R., 1982. Sediment Gravity Flows: II Depositional Models With Special Reference To The Deposits Of High-Density Turbidity Currents, SEPM: Journal of Sedimentary Research 52(1), 279-297. https://doi.org/10.1306/212F7F31-2B24-11D7-8648000102C1865D

Mayall, M., Jones, E., Casey, M., 2002. Turbidite channel reservoirs-Key elements in facies prediction and effective development. Marine and Petroleum Geology 1911. 111-142. https://doi.org/10.1016/j.marpetgeo.2006.08.001

McHargue, T.R., Pyrcz, M.J. Sullivan, MD, Clark, AD, Fildani, A., Romans, B.W., Covault, J.A., Levy, M., Posamentier, H.W., Drinkwater. N.J., 2011. Architecture of turbidite channel systems on the continental slope: Patterns and predictions. Manine and Petroleum Geology 28(3), 728-743. https://doi.org/10.1016/j.marpetgeo.2010.07.008

Miall, A.D., 1985. Architectural Element Analysis: A New Method Of Facies Analysis Applied To Fluvial Deposits. Earth-Science Reviews 22, 261-308. https://doi.org/10.1016/0012-8252(85)90001-7

Mutti, E., 1972. Turbidites of the northern Apennines: Introduction to facies analysis, International Geology Benew 20(2), 125-166. International Geology Review, 20(2), 125–166. https://doi.org/10.1080/00206817809471524

Nurani, A., 2010. Biofacies dan biostratigrafi berdasarkan analisis foraminifera pada outcrop Sungai Cipamingkis, Kecamatan Jonggol, Kabupaten Bogor, Provinsi Jawa Barat. Undergraduate Thesis. Universitas Padjadjaran, Bandung, 106.

Schwarz, E., Arnott, R.W.C., 2007. Anatomy and evolution of a slope channel-complex set (Neoproterozoic Isaac Formation, Windermere Supergroup, southern Canadian cordillera): Implications for reservoir characterization. Journal of Sedimentary Research 77, 89–109. https://doi.org/10.2110/jsr.2007.015

Sprague, A.R., 2002. The physical stratigraphy of deep-water strata: a hierarchical approach to the analysis of genetically related elements for improved reservoir prediction. AAPG Annual Meeting Abstracts, Houston, Texas, 10-13.

Sprague, A.R., Sullivan, M.D., Campion, K.M., Jensen, G.N., Goulding, F.J., Garfield, T.R., Sickafoose, D.K., 2002. The physical stratigraphy of deep-water strata: a hierarchical approach to the analysis of genetically related stratigraphic elements for improved reservoir prediction. In: Deep-Water Reservoirs of the World, GCSSEPM Foundation 22nd Annual Research Conference, 283-313.

Sprague, A.R. et al., 2005. Integrated slope channel depositional models: the key to successful prediction of reservoir presence and quality in offshore West Africa. CIPM, 1-13.

Sari, R.A.P., Winantris, L. Fauzielly, & Ringga Jayanti, A.G. (2019). Depositional Environmental Changes of Cimanceuri Formation Based on Mollusk Fossil Assemblages in Bayah, Banten Province. Journal of Geoscience, Engineering, Environment, and Technology, 4(2), 66-75. https://doi.org/10.25299/jgeet.2019.4.2.2986

Stow, D., Piper, D., 1984. Fine-Grained Sediments: Deep-Water Processes and Facies. Blackwell Scientific Publication, London. 611-646

Sudjatmiko, S. Effendi, A.C., 1998, Geological Map of the Bogor Quadrangle, Java. Geological Research and Development Centre, Bandung, Indonesia.

Sakilla Gia Mentari, Winantris, Lia Jurnaliah & Novita Iwa Anjani (2025). Depositional Environment of the Late Miocene of Lemau Formation from Bengkulu Basin Based on Palynology in Seluma, Bengkulu, Indonesia. Journal of Geoscience, Engineering, Environment, and Technology, 10(4), 549-554.
https://doi.org/10.25299/jgeet.2025.10.4.19568

Yuskar, Y. & Choanji, T. (2017). Uniqueness deposit of sediment on floodplain resulting from lateral accretion on tropical area: study case at Kampar River, Indonesia. Journal of Geoscience, Engineering, Environment and Technology, 2(1), pp.14–19. https://doi.org/10.24273/jgeet.2017.2.1.12

Yuskar, Y., Bagus Eka Putra, D. & Revanda, M. (2018). Quarternary sediment characteristics of floodplain area: study case at Kampar River, Rumbio Area and surroundings, Riau Province. Journal of Geoscience, Engineering, Environment and Technology, 3(1), pp.63–68 https://doi.org/10.24273/jgeet.2018.3.1.1226