Appendix 1. Coordinates of the studied drill cores and complementary sedimentological results.

1. Coordinates of the studied drill cores

The location and complete reference of all the drill cores presented in this study are given in Supplementary Table 1.

Supplementary Table 1: Location of the studied drill cores

Complete name	Abbreviated name	Decimal Latitude[1]	Decimal Longitude[1]	Drill-core repository
SN4FD00055	FD 55	-6,082286622	-50,19299351	Vale S.A. Núcleo de Carajás
SN5FD00110	FD 110	-6,116937337	-50,13905439	Vale S.A. Núcleo de Carajás
SSDFD00353	FD 353	-6,405362884	-50,34734517	Vale S.A. Núcleo de Carajás
SSDFD00354	FD 354	-6,396814131	-50,34684967	Vale S.A. Núcleo de Carajás
SSDFD00365	FD 365	-6,402548496	-50,33233868	Vale S.A. Núcleo de Carajás
S11D214	S11D214	-6,394350618	-50,32346099	Vale S.A. Núcleo de Carajás
ALM-ALMO-FD052	FD 52	-6,02285	-50,57351	Vale S.A. Núcleo de Carajás
1: WGS 84 reference framework				

2. Description of the upper part of the drill core FD52 (Águas Claras Formation)

2.1. Transition between the Igarapé Bahia Group and the Águas Claras Formation

At 278 m, sedimentary rocks of the Igarapé Bahia Group are sharply cut by a mafic dyke or sill (Fig. S1). Between 278 and 269.5 m, the mafic rock exhibits a fine microlithic texture and contains sedimentary enclaves. From 269.5 to 264.9 m, the mafic rock has a different texture, marked by slightly coarser microlites. Above 269.9 m and up to 217 m, the drill core intersects hydrothermal breccias, mainly made up of quartz veins, with subordinate amounts of basaltic and sedimentary clasts. The transition from the hydrothermal breccias and the overlying sediments is progressive, and the sedimentary protolith is only clearly recognizable above 217 m. Sedimentary facies are markedly different below 278 m and above 217 m, and the latter is attributed to the Águas Claras Formation. The interval ranging from 278 to 217 m is here interpreted as the contact between the Igarapé Bahia Group and the Águas Claras Formation. This contact probably represented a weak plan that channelized both magmatic ascent (thus representing a sill) and hydrothermal fluid. Because of the occurrence of this sill, it is not possible to document the exact nature of the contact between the two sedimentary units, which could be either an erosional unconformity, a paraconformity (hiatus) or a gradual transition.

2.2. Águas Claras Formation

Description. From 217 to 208 m (Fig. S1), the sediments are made up of coarse sand to gravel Fig. S1), constituting a micro-conglomerate with rounded to sub-rounded elements (G3 facies, Table S2). Coarse sandstones locally comprise muddy rip-up clasts (Fig. S1) and exhibit trough-cross stratifications. The beds are decimeter to meter thick and have erosive bases. Above 208 m, medium to coarse sandstone (S3 facies, Table S2) display horizontal or trough-cross stratifications and comprise numerous mud clasts. Just below a mafic sill or dyke intersected by the drill core from 167.5 to 154.5 m (Fig. S1), a ca. 2.5 m thick conglomeratic horizon is made up of angular clasts embedded within a greenish matrix (G4 facies, Table S2). The conglomerate is matrix supported, monomictic, with basaltic clasts, and contains zircon grains as accessory minerals.

Interpretation. Micro-conglomerates with rounded to sub-rounded elements and sandstones with trough-cross stratifications correspond to sinuous crested 3D megaripples (Miall, 1996), indicative of channelized deposits in braided rivers. The few horizontal stratifications in medium to coarse sandstones suggest that channelized flow alternated with episodes of unconfined flow that deposited sheetflood tabular beds. Interpretation of the monomictic conglomerate made up of angular clasts is more equivocal: the proximity of a mafic dyke, the basaltic nature of the clasts and their angular shape suggest that this conglomerate can correspond to a blocky peperite (Busby-Spera and White, 1987), and would thus not be a primary sedimentary structure. An alternative interpretation is to consider the conglomerate as the product of sedimentary reworking of former volcanic rocks through a debris flow (Miall, 1996). In that case, the conglomerate would represent a primary sedimentary feature. This view is supported by the report of volcaniclastic sandstone in the Águas Claras Formation (Trendall et al., 1998). The limited exposure of the drill core does not allow us to provide a definite interpretation.

Supplementary Table 2. Sedimentary facies of the Águas Claras Formation.

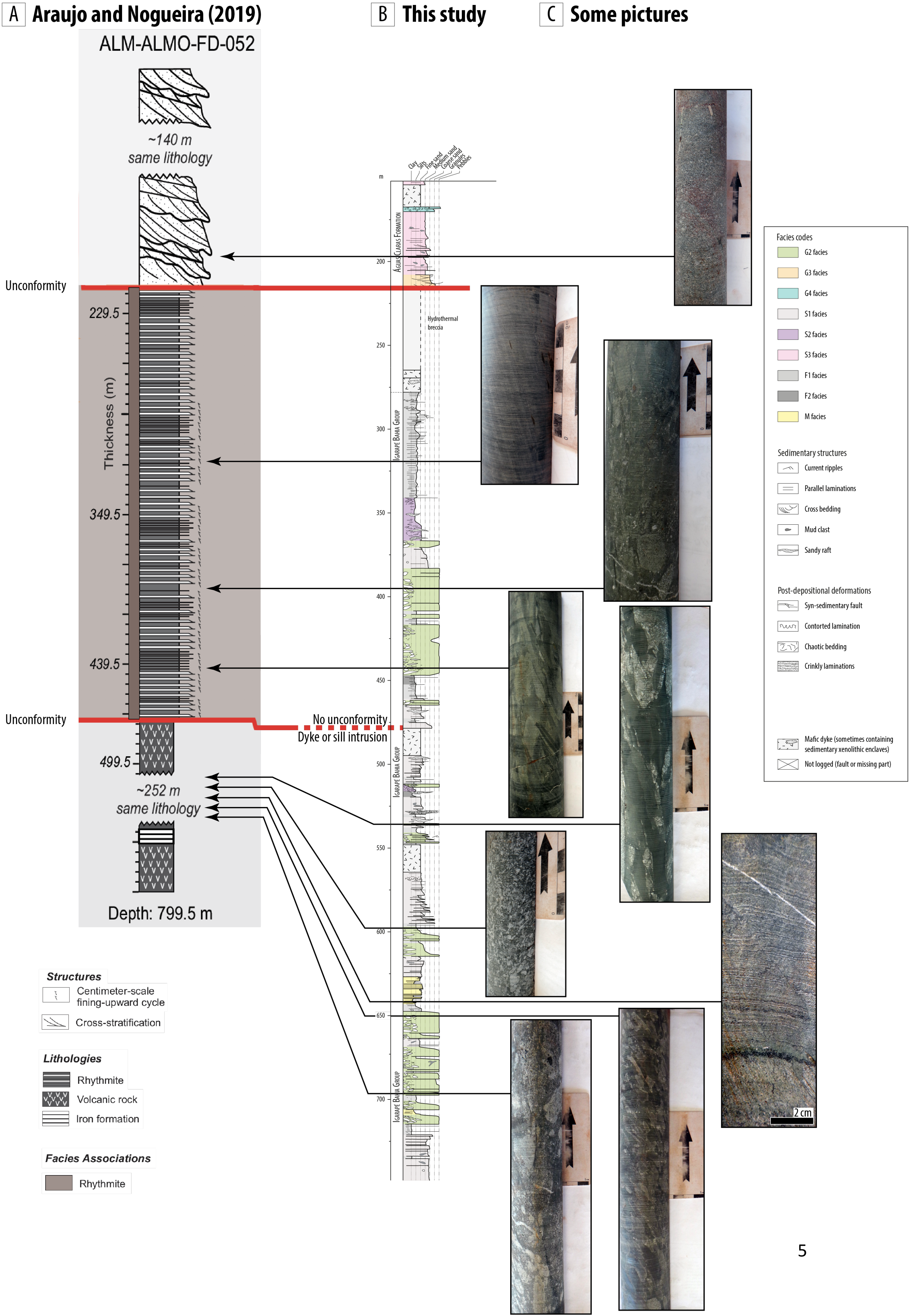
Code	Lithology	Sedimentary structures	Depositional processes
Conglomerate			
G3	Coarse sand to gravel, sometimes containing muddy rip-up clasts (Fig. S1). Bed thickness: dm to m.	Trough-cross bedding. Erosive base.	Tractive current, 3D megaripple migration (Miall, 1996).
G4	Monomictic conglomerate made up of angular, volcanic basaltic clasts. Matrix supported. Bed thickness: m.	Sharp contact with underlying sediments.	Sedimentary reworking of volcanic rocks through debris flow (Miall, 1996) or blocky peperite (Busby-Spera and White, 1987).
Sandstone			
S3	Coarse to very coarse sand. Presence of ripped up mud clasts (Fig. S1).	Planar or sub-planar.	Tractive current, upper flow regime (Miall, 1996).

3. Comparison with previous descriptions

Drill core S11D214. Conglomerate beds in this drill core intercepting the Carajás Formation (G1; Figs. 3, 8 and Table 2) have been reported several years ago, but no specific paleoenvironmental interpretation was proposed at that time (Cabral et al., 2017). Recently, these conglomerates interbedded within cherts and Banded Iron Formation have been attributed to another formation referred to as the Serra Sul Formation and interpreted as subglacial tillites (Araújo and Nogueira, 2019). However, the shape of the rip up clasts, preserving subtle cuspate bending and syn-depositional buckling (Cabral et al., 2017), invalidates a transport by ice glacier. In addition, the sedimentary facies from the Serra Sul are not indicative of a glacial setting (Rossignol et al., 2020).

Drill core FD52. A succinct and imprecise stratigraphic description of the drill core FD52 (Fig. S1A) has previously been presented (Araújo and Nogueira, 2019). Only a small portion of the drill core FD52 described by Araujo and Nogueira (2019), from ca. 330 m to ca. 280 m, actually corresponds to the observed lithology (Fig. S1B). All the other parts of their sedimentological log are markedly different from the actual lithology, as illustrated by various pictures taken along the drill-core (Fig. S1C). Many sedimentary rocks have been mistakenly reported as basalts, and some important lithologies have been missed, such as conglomerate reported as "even parallel fine-grained rythmite" at ca. 390 m (Fig. S1). A mafic dyke has erroneously been interpreted as representing an unconformity of the Igarapé Bahia Group on a basaltic basement (Fig. S1A and B). Stratigraphic descriptions presented by Araujo & Nogueira (2019) should thus be considered with caution.

Supplementary Figure 1 (next page). Comparison of the description of the drill core FD52 by Araujo and Nogueira (2019) and our study. (**A**) Description from Araujo and Nogueira (2019). (**B**). Our study. See Table 2 for a description of sedimentary facies. (**C**). Pictures of representative sedimentary facies. Other pictures are shown in Figs. 10, 11 and 12.



A Araujo and Nogueira (2019)
ALM-ALMO-FD-052
~140 m
same lithology
Unconformity
229.5
Thickness (m)
349.5
439.5
Unconformity
499.5
~252 m
same lithology
Depth: 799.5 m
Structures
Centimeter-scale fining-upward cycle
Cross-stratification
Lithologies
Rhythmite
Volcanic rock
Iron formation
Facies Associations
Rhythmite
B This study
Clay
Silts
Fine sand
Medium sand
Coarse sand
Granules
Pebbles
m
Águas Claras Formation
200
Hydrothermal breccia
250
Igarapé Bahia Group
300
350
400
450
No unconformity
Dyke or sill intrusion
500
Igarapé Bahia Group
550
600
650
700
Igarapé Bahia Group
C Some pictures
Facies codes
G2 facies
G3 facies
G4 facies
S1 facies
S2 facies
S3 facies
F1 facies
F2 facies
M facies
Sedimentary structures
Current ripples
Parallel laminations
Cross bedding
Mud clast
Sandy raft
Post-depositional deformations
Syn-sedimentary fault
Contorted lamination
Chaotic bedding
Crinkly laminations
Mafic dyke (sometimes containing sedimentary xenolithic enclaves)
Not logged (fault or missing part)
2 cm

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