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An Overview of the Amazonian Craton Evolution: Insights for Paleocontinental Reconstruction

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Abstract

The Amazonian craton major accretionary and collisional processes may be correlated to supercontinent assemblies developed at several times in the Earth history. Based on geologic, structural and paleomagnetic evidence paleocontinent reconstructions have been proposed for Archean to younger times. The oldest continent (Ur) was formed probably by five Achaean cratonic areas (Kaapvaal, Western Dhawar, Bhandara, Singhhum and Pilbara cratons). Geologic evidences suggest the participation of the Archaean rocks of the Carajás region in the Ur landmass. Supercontinental 2.45 Ga Kenorland amalgamation is indicated by paleomagnetic data including Laurentia, Baltica, Australia, and Kalahari and Kaapvaal cratons. There is no evidence indicating that Amazonian craton was part of the Kenorland supercontinent. From 1.83 Ga to 1.25 Ga Columbia and Hudsonland supercontinents including Amazonian craton were proposed based on NE portion of the Amazonian craton (Maroni/Itacaiunas province) connection with West Africa and Kalahari cratons. Rodinia supercontinent reconstructions show Amazonia joined to Laurentia-Baltica as result of 1.1 Ga to 1.0 Ga fusion based on the Sunsas-Aguapei belts and Greenville and Sveconorwegian belts, respectivelly. The large Late Mesoproterozoic landmass included also Siberia, East Antartica, West Nile, Kalahari, Congo/São Francisco and Greenland. The 750 - 520 Ma Gondwana assembly includes most of the continental fragments rifted apart during the break-up of Rodinia followed by diachronic collisions (Araguaia, Paraguay and Tucavaca belts). The supercontinent Pangea is comprised of Gondwana and Laurentia formed at about 300 - 180 Ma ago. The Amazonian craton margins probably were not envolved in the collisional processes during Pangea because it was embebed in Neoproterozoic materials. As consequence, Amazonian craton borders have no record of the orogenic processes responsible for the Pangea amalgamation.

Keywords

Amazonian Craton, Tectonic Evolution, Paleocontinents

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1. Introduction

The Amazonian craton (**Figure 1**) is one of the more complete examples of continental crust growth throughout Archaean to Mesoproterozoic. The geologic evolution within this period of time included accretion of juvenile (subduction-related) material and cratonic fragments [1]-[5]. The ages, structures, and compositions of rock units and orogenic events within Amazonia are still imperfectly known, in spite of significant recent advances [6] [7]-[15]. Amazonia is a key piece of the puzzle for many supercontinent reconstructions [16]-[25]. The tentative reconstruction of these paleocontinents takes into account paleomagnetic data, orogenic belts match, geologic provinces match, fossil assemblages and glaciogenic sequences. This work deals with the continental growth of the Amazonian craton and the relationship of these accretionary and colisional processes and supercontinent amalgamations throughout geologic time.

2. Paleomagnetic Concepts

The reconstruction of paleocontinents has been proposed for Archean to younger times. Most of the proposed configurations are based on analyses of geologic and structural evidences but include paleomagnetic database with paleogeographic position and age for each pole. Paleomagnetic pole positions have long been calculated with the assumption that the ancient geomagnetic field was purely that of a geocentric dipole [26]. In addition, the true polar wander (TPW) is described as different poles of the same landmass in different times based on a Earth's geographic reference (**Figure 2**). The sequence of poles displayed in a map (or on a globe surface) defines the trajectory of the landmass during that period of time.

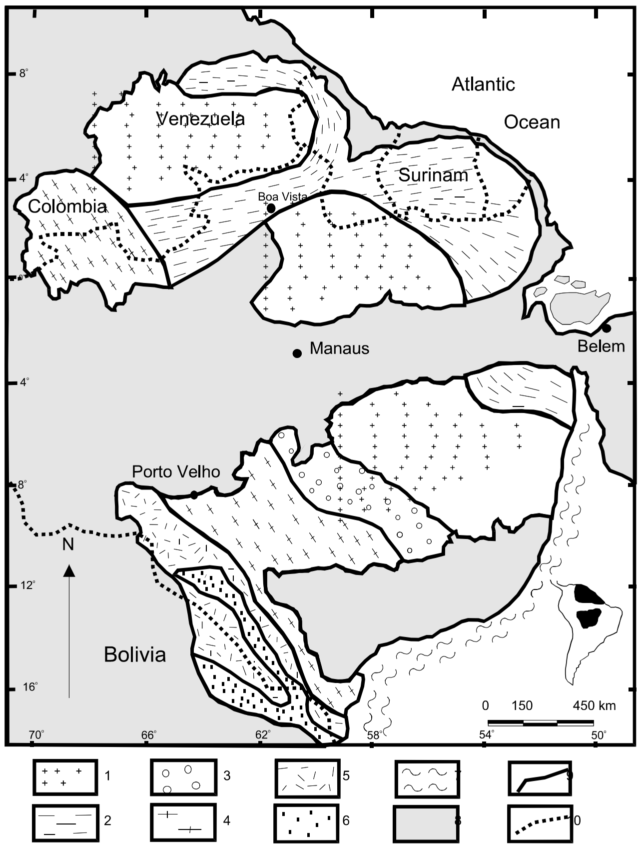

Figure 1. The Amazonian craton tectonic provinces according to Teixeira *et al.* [26] (1989). 1) Central Amazonia; 2) Maroni-Itacaiúnas; 3) Ventuari-Tapajós; 4) Rio Negro-Juruena; 5) Rondoniana-San Ignácio; 6) Sunsas-Aguapeí; 7) Mobile belts; 8) Sedimentary basins; 9) Province borders; 10) Country borders. Modified from [25].

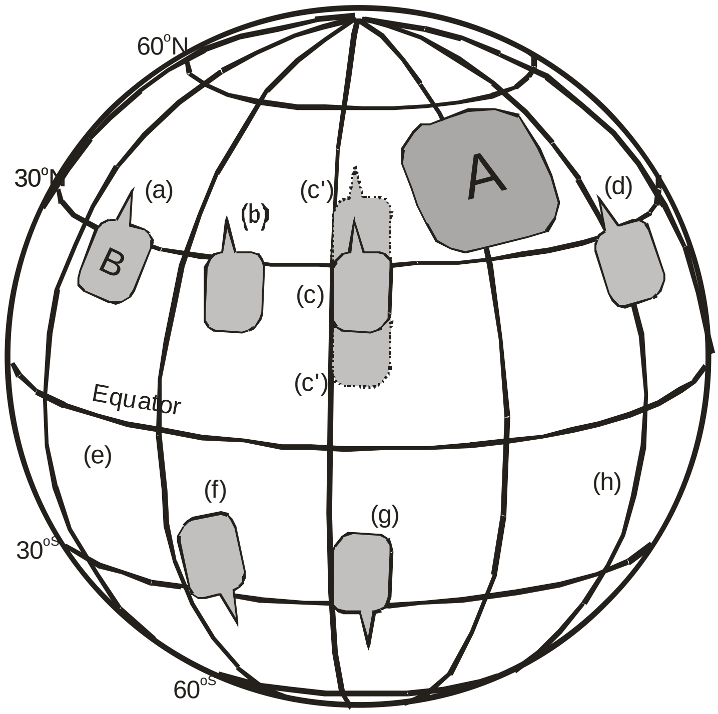

Figure 2. Paleomagnetic poles plotted on an Earth's geographic reference.

At least since the Mesoproterozoic Earth's lithosphere has contained just enough continental material to occupy about a hemisphere when all elements are aggregated [28] [29]. The elements of our planet are in relative motion, requiring approximations of processes operating at timescales encompassing several orders of magnitude. TPW is consistent with continental mobilism corroborated with geological observations. In this way, TPW is measurable today at a rate of about 10 cm/year. Estimates long-term Mesozoic-Cenozoic TPW rates are typically about 1 - 5 cm/year [29].

[30] had illustrated several way how the TPW may be interpreted, as showed in **Figure 3**. The plotted poles (TPW) of a specific landmass (**Figure 3(a)**) when compared with other landmass poles may indicate a collision between both or rifting process (**Figure 3(b)**) and amalgamation (**Figure 3(c)**). The Wilson cycle may be obtained when two landmasses are together at the beginning, followed by a separation and the final collision. The amalgamation of several landmasses may be indicated when a group of landmasses are at the same "place" at the same time.

3. The Archean Continent (Ur)

The continental growth in Amazonian craton started during the Late-Archaean when microntinental cell amalgamation resulted in a continuous sialic crust at about 2.76 Ga. The formation of these fragments started about 3.05 Ga as exampled by the Pium mafic-ultramafic complex. The highly speculative continent of Ur [31] [32] is evidenced only in five Achaean cratonic areas (Kaapvaal, Western Dhawar, Bhandara, Singhbhum and Pilbara cratons) where 3.0 - 2.8 Ga shallow-water supracrustals assemblages are observed. Such as sedimentary units are coeval to sediments of Agua Clara formation intercalated with volcanic rocks (2.97 - 2.90 Ga) and cut by 2.76 Ga mafic-ultramafic layered complex in the Amazonian craton [33]. The sedimentary rocks are comprised of platformal cover suites (pellite, BIF, chert, shale and greywacke) and may suggest the participation of the Achaean rocks of the Carajás region in the Ur landmass (**Figure 4**).

4. Paleoproterozoic Reconstructions (Kenorland, Arctica and Antartica)

The Paleoproterozoic geologic history of the Amazonian craton included huge volume of juvenile magmatism. The lateral accretionary events of the Maroni-Itacaiunas province in the NE sector of the Amazonian craton is

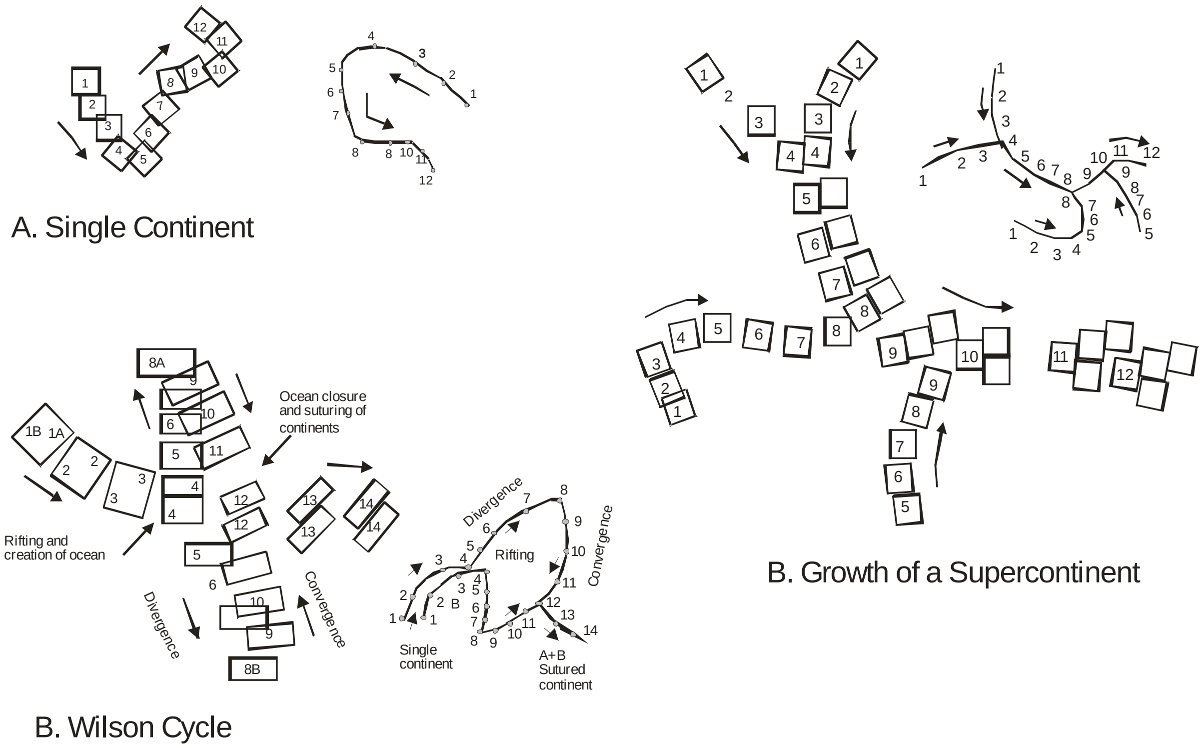

Figure 3. Possible reconstructions of landmasses relationship based on True Polar Wander (TPW). Modified from [29].

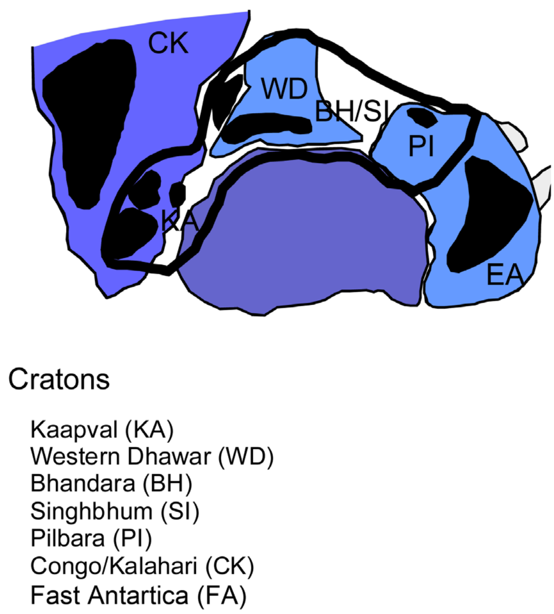

Figure 4. Ur continent reconstruction [32].

demonstrated upon geochronological studies carried out by [7] [11] [14] in French Guyana and Amapa (Brazil). These investigations yielded ages about 2.26 - 2.20 Ga interpreted as the time of juvenile rocks (gabbro and tonalite) formations in magmatic arc setting followed by collisional magmatism (at about 2.19 - 2.13 Ga) represented by granitoids. Supercontinental collage during Paleoproterozoic times is indicated by paleomagnetic data according to [25]. In this way, the Kenorland (**Figure 5**) amalgamation includes Laurentia (Superior and Wyoming cratons), Baltica (Karelia craton), Australia (Yilgarn craton), and Kalahari and Kaapvaal cratons at about 2.45 Ga. A second continental mass is proposed at that period of time by [34]. The Zimvaalbara landmass was composed by Zimbabwe, Kaapvaal and Pilbara cratons based on paleomagnetic informations. Between 2.40 - 2.20 Ga Superior, Karelia and Kalahari cratons experienced successive glaciations, recorded by glaciogenic units and paleoweathering layers (strongly indicating their previous collage) and the lack of such sedimentary rocks suggest that Amazonian craton (where only platformal basin sedimentation was recorded at that time according to [35] was not part of the Kenorland supercontinent (**Figure 6**), which had its break up during rifting processes ca. 2.20 - 2.21 Ga.

The continent Arctica (**Figure 7**) was proposed by [31] from 2.5 Ga to 1.8 Ga. This continent includes Laurentia (Slaves, Wyoming, Superior cratons and Rae and Hearne provinces), Siberia (Aldan and Anabar craton) and Greenland and probably the Amazonian craton did not participate of this landmass. By other hand, [31] also proposed the continent Atlantica, formed at about 2.0 Ga and comprised of Amazonian, São Francisco, Rio de La Plata, West Africa, West Nile and Congo/Kalahari cratons. The interval ages of subduction and collision

Figure 5. Kenorland paleocontinent reconstruction (Modified from [25]).

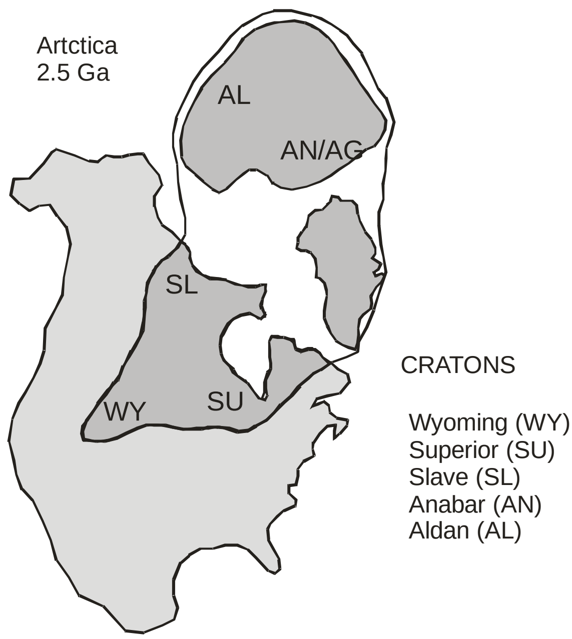

Figure 6. Arctica paleocontinent reconstruction (Modified from [32]).

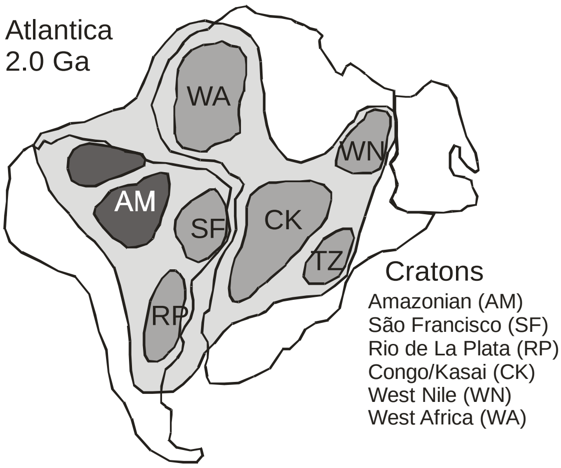

Figure 7. Antartica paleocontinent reconstruction (Modified from [32]).

(2.26 - 2.13 Ga) in French Guyana and Amapa (Brazil) suggest the collage of Amazonian and West Africa cratons as pointed out by [33] [35] suggested the inclusion of the Amazonian-West Africa cratons in the Atlantica supercontinent of [31] based also on the intracratonic environment of the Uatumã volcanic (piroclastic and lava flows) rocks formed from 1.97 to 1.85 Ga [36].

The Tapajós province developed in the SW portion of the Achaean province from 2.05 Ga to 1.88 Ga [3] [4] [8] [9]. The juvenile rocks of this province are comprised of calcalkaline magmatism dated at 2.05 - 1.96 Ga (Cuiu-Cuiu magmatic arc) followed by Alto K'Parauari granitoids (1.88 Ga) defining at least two accretionary events. At the same time (2.00 - 1.96 Ga) in Roraima (northern portion of the Amazonian craton) calcalkaline juvenile rocks were found by Reis *et al*. [5]. These 2.05 - 1.88 Ga orogenic belts in the SW margin of Amazonia may indicate a continuous (lateral) accretionary process with juvenile characteristics without collisional process recorded within this period of time.

5. Paleo-Mesoproterozoic Reconstructions (Columbia and Hudsonland)

The Mesoproterozoic geologic evolution of SW of the Amazonian craton is comprised of juvenile accretions and crustal rework. This region has been divided into three major domains ([2] [36]: the Rio Negro-Juruena 1.79 - 1.52 Ga), the Rondonian-San Ignácio (1.51 - 1.34 Ga), and the youngest Sunsás-Aguapeí (1.24 - 1.00 Ga). Each province has been divided into orogenic belts. In this way, the Rio Negro/Juruena Province is represented by the 1.79 - 1.74 Ga Alto Jauru and the 1.58 - 1.52 Ga Cachoeirinha magmatic arcs ([6] [37], respectively). The Rondonian/San Ignácio Province is marked by important events involving magmatic arc settings and continental collision processes between 1.51 Ga and 1.34 Ga. These comprise the 1.51 - 1.48 Ga Rio Alegre, the 1.45 - 1.42 Ga Santa Helena and the 1.42 - 1.32 Ga San Ignácio arcs [2] [38].

From 1.83 Ga to 1.25 Ga two supercontinents including Amazonian craton were proposed. The first named Columbia (**Figure 8**; [31] [39]) takes in account paleomagnetic and tectonic data and substitute the earlier proposition of the Nena continent (**Figure 9** and **Figure 10**) suggested by [30]. The authors suggest the NW portion of the Amazonian craton (Maroni/Itacaiunas province) in close connection with West Africa and Kalahari cratons at about 1.80 Ga. Corroborating this hyphothesis large area of Amazonia were covered by cratonic and subordinate shallow marine sedimentary rocks. The Roraima Group is an example of these sequence formed at this time by marine sediments passing upward to continental and intertidal deposits.

The second paleocontinental proposition is known as Hudsonland characterized by [25]. These authors suggested this 1.83 - 1.25 Ga landmass comprised of Laurentia, Baltica and Amazonia, even the complete consolidation of Laurentia fragments was not finished at that time [27]. In this proposition the Ventuari/Tapajós province of the Amazonian craton is linked to Laurentia/Baltica but this large continent probably included other continents such as Australia, Siberia, Ukraine and North China, although paleomagnetic data are still lacking [25] (**Figure 11**).

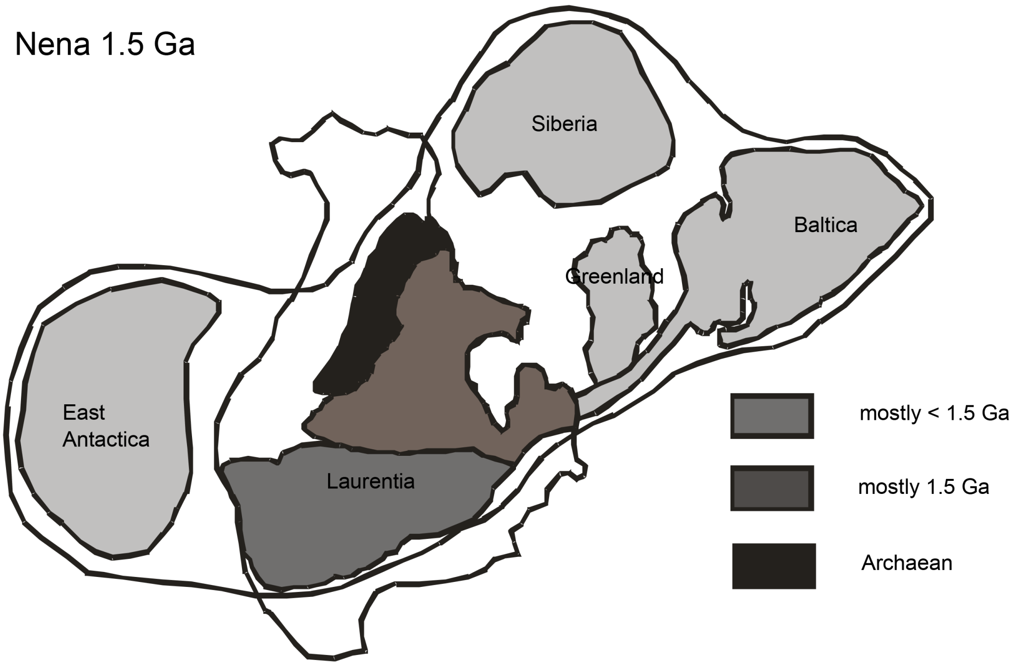

Figure 8. Nena paleocontinent reconstruction (Modified from [30]).

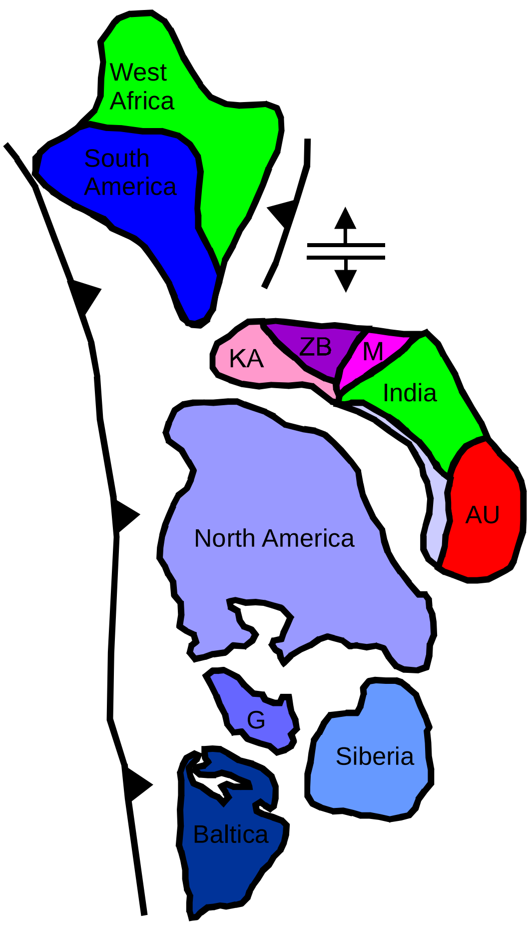

Figure 9. Columbia paleocontinent reconstruction (Modified from [31] [32]).

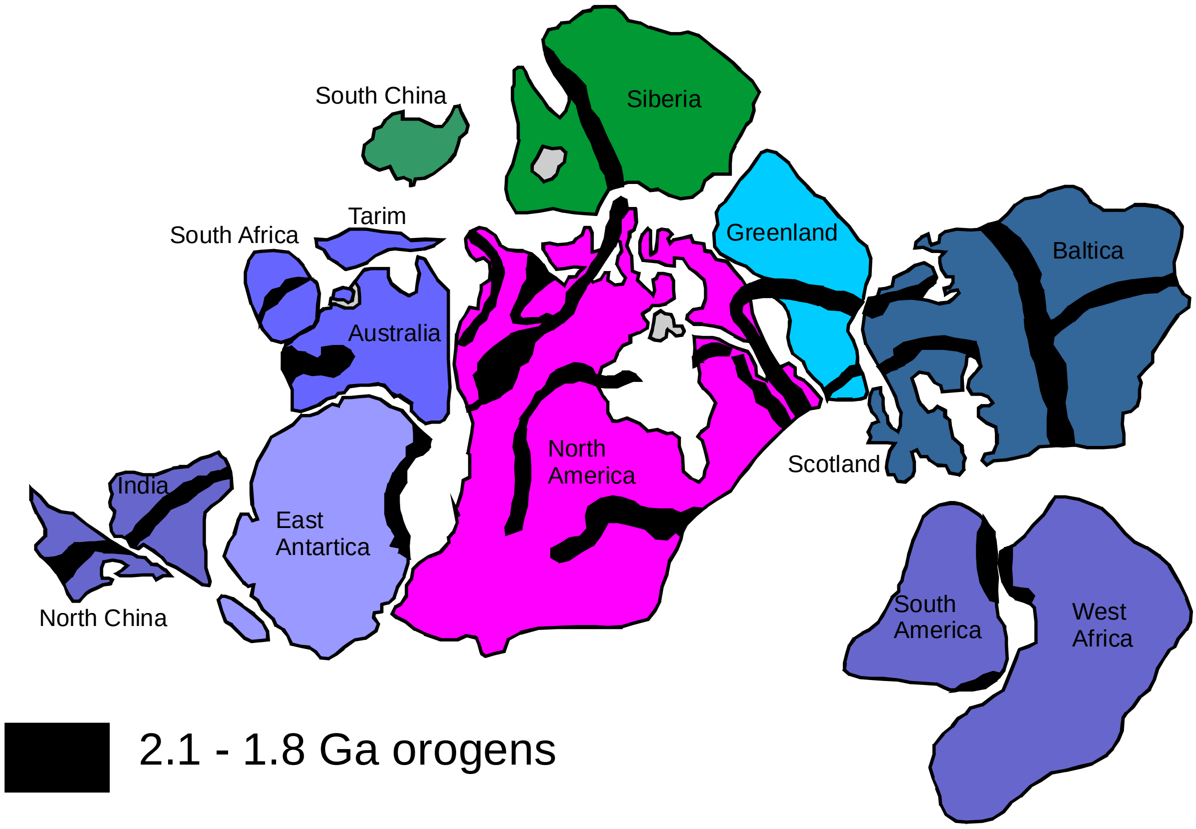

Figure 10. Columbia paleocontinent reconstruction (Modified from [39]).

Figure 11. Hudsonland paleocontinent reconstruction (Modified from [25]).

The Amazonia connection with Laurentia/Baltica during the Hudsonland existence may help with 1.57 - 1.0 Ga rapakivi granites origin approach. In this way, the coeval AMCG suites observed in Baltica and Amazonia strongly suggest a continuous continental margin where orogenic processes accretionated juvenile material and the coeval anorgenic intracratonic magmatism may be explained as representing distal expressions [40] [41] of the long lasting accretional margin. Other genetic hypothesis proposed to the 1.88 Ga anorogenic magmatism [42] [43] and proterozoic anorogenic magmatism in Laurentia [44] take into account the existence of mantle plume or downwelling flow in the mantle, respectivelly. The Hudsonland last until 1.25 Ga when rifting process due mantle plume activity resulted in break up landmass followed by fragments drifting.

Several sedimentary sequences corroborate with Hudsonland hypothesis. The Mesoproterozoic deposits in the central and western part of the Amazonian craton include Prosperança, Acarí and Prainha units comprised of clastic sediments such as coarse graines and micaceous conglomerate. Alkaline basalts are intercalated with arkosic sandstone. Gabbro and diabase intrusions have poorly ages defined at 1.4 - 1.2 Ga. In the eastern part of Amazonia the Cubencranquém Group is comprised of more than 300 m of reddish arkoses sandstones. In the SW part of Amazonian craton the (1.3 - 1.1 Ga) Aguapei Group is comprised of conglomerates, sandstones and siltstones [45].

6. Late Mesoproterozoic Reconstructions of Rodinia (Auswus, Swets and Ausmex)

The youngest Sunsás/Aguapeí Province is comprised of sequences deposited during basin tectonic (1.1 Ga Nova Brasilândia and 1.0 Ga Aguapeí [46] [47] (respectively) and magmatic products (1.0 Sunsás; [48] [49]).

The lack of orogenic events between 1300 - 1250 Ma in the SW Amazonian Craton indicates the initial period of sedimentation referable to the Sunsás, Aguapeí, and Nova Brasilandia basin. The Sunsás orogen has been considered as resulting of the inversion of a passive continental margin, encompassing deep marine turbiditic sediments that have experimented subduction. The deformation and metamorphism in Aguapeí Group (ca. 970 Ma) are probably inboard manifestations (fold and thrust belt) of the more intense continent-continent collision occurring to the west in Bolivia (ca. 1.000 Ma Sunsás Orogen). Important anorogenic magmatism is reported widespread SW Amazonian Craton during this period of time. Between 1.1 and 1.08 Ga important units recorded in the Nova Brasilândia Terrane and linked to the rifting stage include mantle-derived tholeiitic sill, stocks, gabbro and diabase dykes, emplaced at 1150 Ma [46].

Hoffman [16], Dalziel [17] [18] and Meert and Torsvik [50] show Amazonian craton joined to Laurentia-Baltica in Rodinia (**Figure 12**) as a result of 1.1 to 1.0 Ga fusion based on the greenvillian-age Sunsas-Aguapei belts. Others authors that suggested plate reconstruction and interpreted the Amazonian craton as the

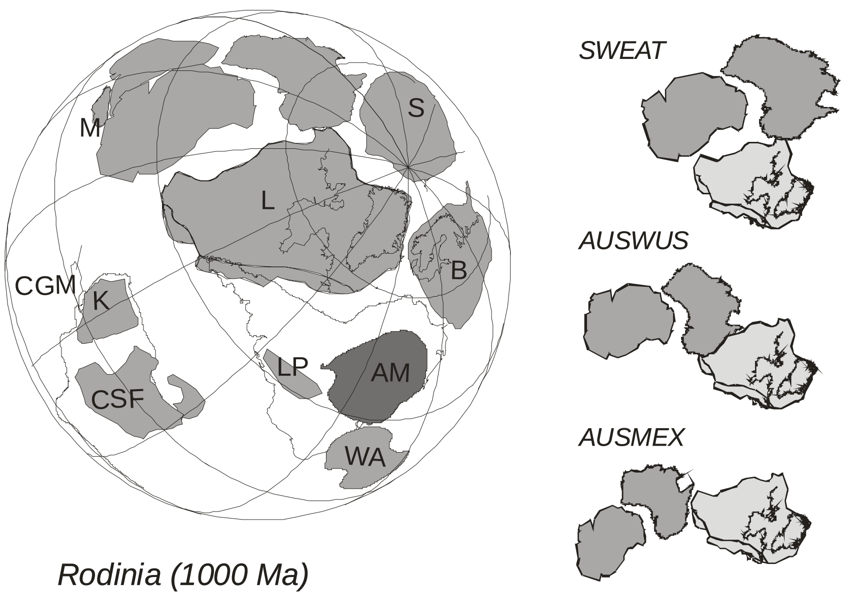

Figure 12. Reconstructions of Rodinia (SWEAT, AUSWUS and AUSMEX hypothesis) ([63]).

colliding continent are [19] [20] [51] [52] including Siberia, East Antartica, West Nile, Kalahari, Congo/São Francisco and Greenland. [21] suggested that Amazonia was also joined to Laurentia-Baltica at 1.6 Ga and separated from it during Mesoproterozoic rifting [53] that began a Wilson cycle which ended with formation of Rodinia. [22] [23] presented paleomagnetic data that support the juxtaposition of Amazonia with Laurentia-Baltica ca. 1000 Ma what is corroborated by the geologic data described in the Sunsas-Aguapei belts [47] [48] [54] and Greenville [55] and Sveconorwegian [56] in addition to the palomagnetic data comparison. In addition, [24] presented important paleomagnetic data indicating previous Amazonia and Laurentia connection at 1.20 Ga.

During this period of time (1.15 - 0.8 Ma) the supercontinent Rodinia reconstruction takes in account the presence of the Amazonia craton in different ways cited as SWEAT initially suggested by [57] and advanced by [58] (1991), [16] (1991) and [19]; Other two Rodinia reconstruction hypothesis proposed are refered as AUSWUS [59] and AUSMEX [25] configurations. The first one comprises a proposition where Australia is connected to the (actual) NW part of Laurentia. The second proposition Australia is connected to the (actual) western part of Laurentia. And the last hyphothesis Australia was connected to the (actual) SW part of Laurentia where Mexico territory is located.

Post-Rodinia sedimentation is well recorded in SW Amazonian craton and includes Palmeiral, São Lourenço (oligomitic conglomerate), Pacaas Novos (feldspathic sandstones and siltstone and argilite intercations), Uopianes (arkosic sanstones intercalated with ash-tuff volcanoclastic rochs) deposits [60]. Post-Rodinia anorogenic magmatism Santa Clara (1.052 Ma), Costa Marques (1.018 Ma) an Young granites of Rondonia (995 Ma) are characterized as bimodal A-type rapakivi granites.

The breakup of Rodinia started at about 0.9 - 0.8 Ga as result of plume action beneath the large long lasting landmass [16] [61]. The separation of the fragments was responsible for the development of widespread Neoproterozpoic sedimentary and volcano sedimentary domains, many of which have been transformed into mobile belts [62].

7. Neoproterozoic Reconstructions (Gondwanaland)

The Gondwana includes all the continental fragments on Earth, with exception of the Laurasia land. This collage was the result of the assembly of cratonic fragments, with special regard to Precambrian of the South America Platform, related to the huge continental lithosphere plates [62] [64] that were rifted apart during the break-up of Rodinia at the beginning of the Neoproterozoic [18] [63]. Successive collision and plate indentation processes during the global Brasiliano-Pan African orogenic cycle record the further amalgamation of these shields to form the Gondwana Supercontinent (**Figure 13**) [65]-[67].

The oldest pre-collisional activity in South America platform is recorded in the Brasilia belt, with the development of the Mara Rosa magmatic arc at ca. 930 - 820 Ma [68] and the closure of the Goianides ocean. Continental collision started at ca. 760 Ma with the dockage of Archean and Mesoproterozoic terranes (**Figure 13(a)**). The Brasilia belt (including older terranes) was the result of the ca. 630 Ma collision of the São Francisco craton and the Rio de la Plata craton (and its probable extension represented by the Rio Apa Block, a cratonic fragment underlying the sedimentary rocks of the Paraná basin named Paranapanema block). In southern Brazil occurred the São Gabriel magmatic arc at ca. 750 - 700 Ma [69], indicating an ocean closure (probably an extension of the Goianides ocean) and starting the assembly of Rio de la Plata and Luis Alves cratonic fragments (**Figure 13(b)**). The collision betweem Amazonian craton and West Africa craton is recorded by the Gurupi belt, which ages are about 580 - 540 Ma (**Figure 13(c)**).

Following the crustal history cited above, the collision of the southern region of the Amazonian craton occurred not only with the Paranapanema cratonic fragment. At that moment (541 - 531 Ma) important terranes and microplates had already assembled. Probably the São Francisco craton was joined to Rio de La Plata cratonic fragments (**Figure 13(d)**). In this way the Amazonian craton collided at 541 - 531 Ma with this continuous continental mass (São Francisco-Rio de la Plata-Luis Alves). In addition, the Rio Apa block collided to the Rio de La Plata craton and originated the southernmost branch of the Paraguay belt [70] (**Figure 13(d)**); and the collision between the Rio Apa block and Amazonian craton originated the western branch of the Paraguay belt denominated as Tucavaca [48] (**Figure 13(d)**). Practically simultaneously to these collisions, there occurred the collision of the last accretion of Ribeira belt in SE Brazil (Buzios orogeny), corresponding to the collision of the Congo craton and the São Francisco craton (**Figure 13(d)**). And probably at the end of these two last orogenies

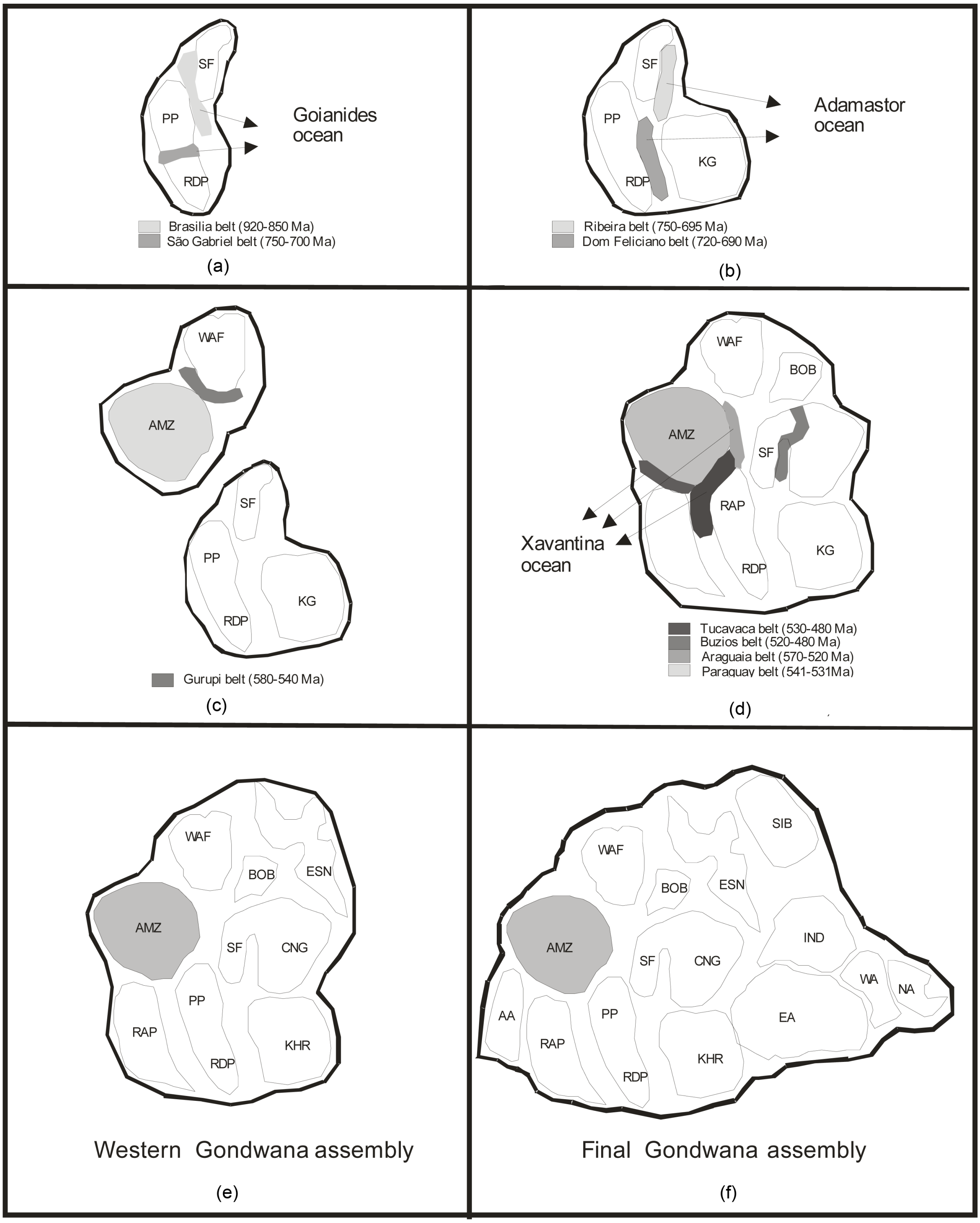

Figure 13. Reconstruction of Gondwanaland.

(**Figure 13(e)** and **Figure 13(f)**), the Gondwana supercontinent was formed.

The more extensive occurrences of sedimentary rocks related to the Gondwana supercontinent amalgamation lie on Proterozoic syneclises along depositional sites that later became depocenters throughout the Paleozoic. The filling of these syneclises show cratonic sequences as recorded by the Silurian-Devonian and Eo-Carbonifefous units comprised of mature sediments with chrono-paralel beds developed under glacial conditions. The late-Carbonifeorous to Triassic sequence records several glacial episodes, marine regressions and ultimately deposition of continental sediments containing red beds [32].

8. Paleozoic Reconstruction (Pangea)

The supercontinent Pangea (**Figure 14**) was formed by the collision of the Gondwana and Laurentia about 300 Ma ago. This assembly occurred mostly in the middle to late Paleozoic, culminating the collision of nortwest Africa with eastern North America [65]. The largest area of accretion was in Asia, where the North and South China and Kasakstan cratons were embebed in broad suites of arcs and oceanic materials [32]. Microplates and juvenile material formations also are observed in Europe at this time. In this way, South America margins were not involved in the collisional processes during Pangea collage, and consequently the Amazonia craton was part of an interior land. As consequence of this protected area, the Amazonia craton borders have no record of the orogenic processes responsible for the Pangea amalgamation.

Sedimentary covers during supercontinent Pangea existence are widespread in South America platform. In Amazonia craton there was a syneclesis with a important pile of sediments deposited during the Gondwana stabilization. The basin was completely restructured in the beginning of Permian, mostly during Upper Jurassic and Lower Cretaceous. New conditions included development of linear uplift zones, intrusions of diabase dikes and eruption of lavas. Sedimentation was restrict to fluvial and eolian deposits and the Triassic is marked by a major interruption of sedimentation. Pangea break up probably is result of plumes action as recorded by swarm dykes followed by rifting processes and ocean opening.

9. Conclusions

Very large supercontinent assemblies developed at several times in the Earth history and the Amazonian craton major tectonic elements may be correlated to these accretionary and collisional processes. Based on geologic, structural and paleomagnetic evidence paleocontinent reconstructions of the Amazonian craton have been proposed from Archean to earlier times as following:

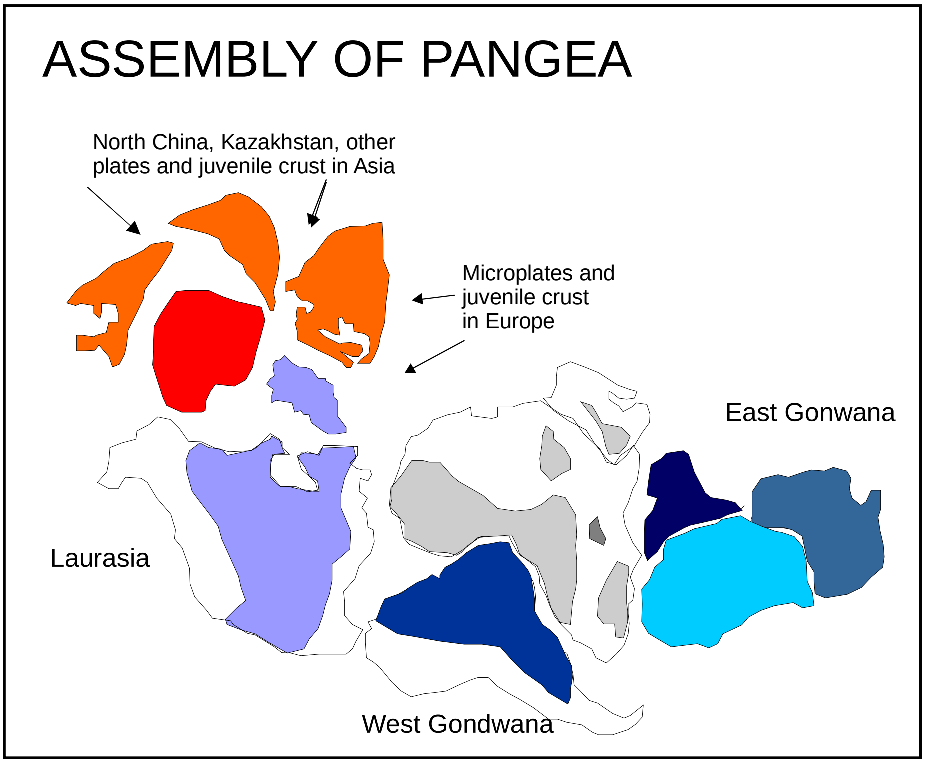

Figure 14. Reconstruction of Pangea (Modified from [32]).

1) The oldest was Ur continent, with five Achaean cratonic areas (Kaapvaal, Western Dhawar, Bhandara, Singhhum and Pilbara cratons) where 3.0 - 2.8 Ga shallow-water supracrustals assemblages are observed. Coeval sediments of Agua Clara formation intercalated with 2.97 - 2.90 Ga volcanic rocks may suggest the participation of the Achaean rocks of the Carajás region in the Ur landmass.

2) Supercontinental 2.45 Ga. Kenorland amalgamation is indicated by paleomagnetic data including Laurentia (Superior and Wyoming cratons), Baltica (Karelia craton), Australia (Yilgarn craton), and Kalahari and Kaapvaal cratons as recorded by glaciogenic and paleoweathering layers. The lack of such suites suggests that Amazonian craton was not part of the Kenorland supercontinent.

3) From 1.83 Ga to 1.25 Ga two supercontinents including Amazonian craton were proposed: Columbia and Hudsonland. They take into account paleomagnetic and tectonic data indicating that NW portion of the Amazonian craton (Maroni/Itacaiunas province) had close connection with West Africa and Kalahari cratons at that time. Paleomagnetic data also indicate Amazonia (Nova Brasilandia) and Laurentia (Llano uplift) connection at 1.2 Ga.

4) Rodinia supercontinent reconstructions (AUSWUS, SWEAT and AUSMEX) show Amazonia joined to Laurentia-Baltica as result of 1.1 Ga to 1.0 Ga fusion based on the Sunsas-Aguapei belts and Greenville and Sveconorwegian belts, respectively. The large Late Mesoproterozoic landmass included also Siberia, East Antartica, West Nile, Kalahari, Congo/São Francisco and Greenland.

5) The 750 - 520 Ma Gondwana assembly includes most of the continental fragments rifted apart during the breakup of Rodinia at the beginning of the Neoproterozoic. Successive collision and plate indentation processes during the global orogenic events are described as Brasiliano-Pan African, East Africa and Kuunga belts. The configuration of the South America platform was defined during the Gondwana amalgamation when the Amazonian craton was bordered by the Neoproterozoic belts to the east (Araguaia belt), south (Paraguay belt) and southwest (Tucavaca belt). The Paraguay belt is result of the Rio Apa block and Amazonia craton collision [48] [70]. The Paraguay belt is the results of the Paranapanema block and Amazonia craton collision and the Araguaia belt is result of the Brasilia belt (also Neoproterozoic but previouslly formed) and Amazonian craton collision.

6) The supercontinent Pangea is comprised of Gondwana and Laurentia (or Panotia; [32] Brito Neves, 2002) at about 180 - 300 Ma ago. The Amazonian craton margins were not involved in the collisional processes during Pangea amalgamation because it was imbedded in Neoproterozoic materials. As a consequence, Amazonia craton have no record of the orogenic processes responsible for the Pangea amalgamation.

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