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Letters to the Editor

D. Rossetti, P. Mann de Toledo, A.-M. Góes, New geological framework for Western Amazonia (Brazil) and implications for biogeography and evolution, Quaternary Research 63 (2005) 78–89.

Rossetti et al. (2005) published a broad-ranging paper on the late Neogene and Quaternary history of the Amazon region, mainly based on outcrop study, radar mapping, and radiometric (^{14}C) dating. The authors documented the presence of fluvial facies successions from almost all western and central Brazilian Amazônia. By means of heavy mineral assemblages, they characterized successive fluvial units and they were able to show that 'structural arches' within Brazilian Amazônia are subsurface features that cannot be of importance for the present-day distribution (and diversity) of Amazonian biota. However, the authors, heavily relying on ^{14}C data, also developed a whole new concept of Amazonian history that merits some comments.

Major surfaces of western Brazilian Amazônia are attributed to fluvial units Q1 and Q2 by Rossetti et al. (2005). These coarse-grained units yielded ^{14}C ages of ca. 27,000 yr and more than 40,000 ^{14}C yr B.P. However, the proximity of the samples to the surface introduces the possibility that the ^{14}C ages in fact represent ages of groundwater (e.g., recent humic acids) or contamination from soil organic matter. Samples older than ca. 50,000 years contain so little ^{14}C (or none at all) of its original organic material that any amount of contamination with young organic matter produces an age which is in general totally inconsistent with its real age. In the case of Amazônia, aberrant ^{14}C ages are a well-known problem. For example, Kronberg et al. (1989) report a 13,390 ^{14}C yr B.P. age for a shell fragment from a well in the Javary area at 130 m depth. The shell fragment is from intervals attributed to the Pebas/Solimões Formation, a Middle Miocene unit (see Kronberg et al., 1991; Latrubesse and Rancy, 1998; Campbell and Frailey, 1984; Hoorn, 1993). The reported ^{14}C ages for the fluvial units Q1 and Q2 are therefore unreliable and in need of alternative confirmation. If the reported ages are correct this would imply that almost the entire surface of lowland Brazilian western Amazônia has been formed in the past 40,000 years. It also implies that major accretion took place on relatively high terra firme in times that Amazonian rivers deeply cut into their own valleys due to the glacial low sea levels (Irion et al., 1997, 1999; Keim et al., 1999).

In their new model for the history of the Amazon, Rossetti et al. (2005) propose a drainage direction of the Amazon system west of Manaus (65° W) towards the NNE (Essequibo region, Guayana) for most of the Quaternary. This change is explained by tectonic uplift interpreted from radar maps. We do not have the radar maps cited by the authors, but we have the excellent maps of Projeto Radam (Ministério das Minas e Energia, 1971–1972). From those maps, we are unable to conclude that the Amazon flowed at any period of the Quaternary towards the Essequibo. Additionally, during our field investigations in the Solimões–Negro–Branco area we encountered interglacial depositional sequences covering the late Middle Pleistocene to the present (Irion, 1984). We are currently preparing a new article on these sequences. No clay-mineral assemblages typical of Andean provenance (smectite, chlorite and illite) were found. Finally, an Amazon outflow in the present-day Essequibo region for most of the Quaternary as proposed by Rossetti et al. (2005) is not in agreement with near-continuous indications for massive Andean input in the present-day Amazon cone (e.g., Debrabant et al., 1997; Haberle, 1997) and Ceara rise (Curry et al., 1995; Dobson et al., 1997, 2001; Harris and Mix, 2002) at least since the Late Miocene. We think that most Quaternary deposits in the Manaus–Macapa area representing an eastward Amazon flow have been eroded during glacial lowstands (of which the channel of the Rio Negro at Manaus, more than 100 m deep, ca. 2000 km upstream of the present-day mouth is a testimony).

The work of Rossetti et al. (2005) frames the importance of the study of surface geology and geomorphology for understanding the Quaternary and Neogene history of the poorly understood Amazon region. Unfortunately, wrong ^{14}C ages have led these very experienced Amazonian geologists to propose an alternative history of the Amazon region that is in need of alternative testing and confirmation and seems in disagreement with other studies.

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Reply to Letter to the Editor

New geological framework for Western Amazonia (Brazil) and implications for biogeography and evolution.

In their discussion of our paper on the Miocene to Quaternary geological history of Western Amazonia (Rossetti et al., 2005), Irion et al. (2005) raised some interesting points, especially concerning carbon rejuvenation and resulting potential inaccuracies in our age determinations. However, our geologic interpretation did not rely on ^{14}C dating alone, but on its integration with sedimentologic, geomorphologic and stratigraphic information. We recognize that the number of dates is inadequate for a precise reconstruction of the depositional events of such a large region, particularly considering its very complex geological dynamics during the Quaternary. Certainly, more dates must be determined before one is able to establish a robust and more complete reconstruction of Quaternary history in Amazonia. However, we would like to stress that the ^{14}C dates we obtained do agree with the expected stratigraphic relationships of the sedimentary units distinguished on the basis of sedimentology and geomorphology, even for deposits tens or hundreds of kilometers apart. Likewise, the ages we obtained within a single profile are progressively younger upward, which increased our confidence in them as true ages, rather than a result of carbon contamination.

Our data are in good agreement with many previously established ^{14}C ages for deposits in Western Amazonia (e.g., AbSaber, 1997; Simões Filho et al., 1997; Desjardins et al., 1997; Latrubesse and Franzinelli, 1998; Mayle et al., 2000; Behling and Costa, 2000; Behling et al., 2001; Freitas et al.,