Gulf of Guinea continental slope and Congo (Zaire) deep-sea fan: 
Sr–Pb isotopic constraints on sediments provenance from 
ZaiAngo cores

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Abstract

Sediment accumulation in the continental margin of Equatorial Central Africa is mostly derived from terrigenous flux of the larger (Congo, ex-Zaire) and smaller coastal rivers. In order to determine the present-day respective contributions of these different sources, we analysed the Pb–Sr isotopic compositions of late Quaternary sediments accumulated on the continental margin and Congo deep-sea fan. The isotopic data of eight piston-cores from the ZaiAngo project (Ifremer–Total) show a strong geochemical similarity between sediments from distant cores situated on the slope near the Congo estuary. That can be explained by the spreading of the Congo sediment plume over extensive areas of the margin. However, the core located at the northern boundary of the Congo River influence has higher 87Sr/86Sr ratio, suggesting a melange with a more radiogenic source probably provided by the small but numerous rivers of this coast.

The differences observed between present-day samples from Congo channel and from the terminal depositional lobe suggest a segregation of the sand along the channel during the transit which creates a Pb isotopic fractionation. Therefore, the comparison between Sr and Pb isotopes shows a strong discrimination of Pb according to sedimentation processes while Sr isotopes seem directly influenced by the coastal rivers contributions.

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1. Introduction

The Equatorial western African margin, offshore Gabon, Congo and Angola, presents large depocenters where sediments have been accumulating since Early Cretaceous rifting. During the Tertiary, the accumulation rate increased drastically with the development of several turbidite deep-sea fans (Fig. 1). The largest one, the Congo deep-sea fan (Droz et al., 2003; Savoye et al., 2000) is fed by the second largest watershed in the world (3.7 106 km2) which led to the deposition of up to 4.5 km of terrigenous turbidites between Oligocene and Present (Anka and Séranne, 2004). One striking difference between the Congo and other major rivers in the world is its direct link between the river mouth and the abyssal plain through the deeply incised canyon that cuts across the
Since the formation of this canyon, in latest Miocene time (Anka, 2004), most of the terrigenous material provided by the Congo River bypass the continental margin (shelf and slope) and are directly delivered to the deep basin. The rest is shifted northward and reaches the Congo–Gabon boundary on the shelf. Sedimentation on the slope is dominated by hemipelagic drape with high sediment accumulation rate (Bongo-Passi, 1984). The smaller rivers (Ogooue, Kouilou, and Kwanza) deliver terrigenous sediments on the shelf, where they are re-worked by NW directed long-shore drifts that build extensive sand bars along the Congo and Gabon shoreline.

The low present-day, instantaneous, measurements of suspended load from the Congo River (2 $10^6$ t/yr, Harrison, 2000): 1 — do not account for the Oligocene to Present sediment accumulation on the Equatorial West African margin and Congo deep-sea fan (0.5 $10^6$ km$^3$, Anka, 2004; Leturmy et al., 2003); and 2 — contradict the long-term increase of the terrigenous accumulation during the Tertiary (Séranne, 1999).

Previous works have documented and stressed the influence exerted by the Quaternary climate change in continental Central Africa on terrigenous sedimentation to the continental margin (Giresse, 1978; Giresse et al., 1982). Climate changes produced varying responses of continental erosion in drainage areas and therefore in the sediment flux to the margin (Bonifay and Giresse, 1992; Giresse and Barusseau, 1989). In addition, climate changes are expected to modify the respective contribution of each river, with specific Pb and Sr isotopic signature. In order to reconstruct the origin of Quaternary sedimentation on the continental margin, the first step is to constrain the origin of the present-day terrigenous sediments. We thus investigate the Sr and Pb isotopic compositions of cores from the continental margin and the Congo deep-sea fan, respectively, first as a signature of the contribution of Congo River, and second as evidence for sediment partitioning during transport.

2. Location and sampling

The Congo deep-sea fan is located on a mature and passive continental margin that resulted from the Early Cretaceous opening of the South Atlantic Ocean (130 Myr, Marton et al., 2000). The ZaiAngo Project
was developed by IFREMER and TOTAL to study the different aspects of the Congo sedimentary system and the adjacent Congo–Angola margin. We analysed 22 samples from 8 piston-cores (Fig. 1 and Table 1) provided by this Project. The distribution of the analysed samples was chosen to be representative of three potential sedimentary sources: the Congo, Ogoue and Kouilou Rivers.

The KTZai 2 and KTZai 3 cores, situated on the upper slope, in front of the Kouilou River estuary, are mainly composed of hemipelagic clay. The entire 10 m section recovered at site KTZai 1, located on the upper slope, north of the Congo canyon, consists of hemipelagic sediments. KZ2-04 and KZ2-06 cores, located on the middle slope, south of the Congo canyon, are also dominated by hemipelagic drape. The KTZai 1 core situated on the slope of the Gabon margin, near the northern boundary of the Congo River influence, is characterised by hemipelagic clays.

Finally, two cores were selected on the Congo deep sea fan: 1—The KZai 6 core, which is mainly composed of sands, is situated on the active axis of the channel. 2—The KZai 11 core, which is composed of slightly silty clays in its lower part and fine sands in its upper part, is located on the median part of a sandy lobe.

### Table 1

<table>
<thead>
<tr>
<th>Samples</th>
<th>(87Sr/86Sr) L</th>
<th>(87Sr/86Sr) R</th>
<th>(206Pb/204Pb) WR</th>
<th>(207Pb/204Pb) WR</th>
<th>(208Pb/204Pb) WR</th>
</tr>
</thead>
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**KZai 1** — latitude: 01° 29’ 87° S — longitude: 08° 29’ 84° E — water depth: 580 m

| 1/8 (57 cm) | 0.70915 ± 0.00002 | 0.75485 ± 0.00003 | 19.012 ± 0.009 | 15.841 ± 0.009 | 39.827 ± 0.029 |
| 3/8 (329 cm) | 0.70920 ± 0.00002 | 0.76567 ± 0.00003 | 19.054 ± 0.008 | 15.869 ± 0.009 | 39.923 ± 0.029 |
| 8/8 (751 cm) | 0.70903 ± 0.00002 | 0.74761 ± 0.00002 | 19.034 ± 0.009 | 15.837 ± 0.009 | 39.942 ± 0.029 |

**KTZai 2** — latitude: 04°10’ 75° S — longitude: 10°30’ 94° E — water depth: 905 m

| P (10 cm) | 0.70914 ± 0.00002 | 0.74145 ± 0.00002 | 19.161 ± 0.009 | 15.779 ± 0.009 | 39.322 ± 0.029 |
| C (1180 cm) | 0.70920 ± 0.00002 | 0.73450 ± 0.00005 | 19.238 ± 0.009 | 15.793 ± 0.009 | 39.433 ± 0.028 |

**KTZai 3** — latitude: 04° 17’ 49° S — longitude: 10° 30’ 64° E — water depth: 990 m

| P (10 cm) | 0.70918 ± 0.00002 | 0.73475 ± 0.00002 | 19.208 ± 0.009 | 15.786 ± 0.009 | 39.396 ± 0.029 |
| C (1150 cm) | 0.70922 ± 0.00002 | 0.71287 ± 0.00002 | 19.235 ± 0.009 | 15.788 ± 0.009 | 39.318 ± 0.029 |

**KZai2-06** — latitude: 07° 39’ 75° S — longitude: 11° 41’ 98° E — water depth: 1349 m

| 1/3 (6–7 cm) | 0.70926 ± 0.00002 | 0.73116 ± 0.00003 | 19.126 ± 0.009 | 15.763 ± 0.009 | 39.298 ± 0.029 |
| 3/3 (286–287 cm) | 0.70916 ± 0.00001 | 0.72133 ± 0.00004 | 19.118 ± 0.008 | 15.770 ± 0.009 | 39.309 ± 0.029 |
| 5/3 (408–409 cm) | 0.70914 ± 0.00002 | 0.72497 ± 0.00002 | 19.173 ± 0.012 | 15.798 ± 0.013 | 39.409 ± 0.037 |
| 9/3 (824–825 cm) | 0.70924 ± 0.00002 | 0.72115 ± 0.00010 | 19.131 ± 0.008 | 15.794 ± 0.009 | 39.378 ± 0.028 |
| 12/3 (1151–1152 cm) | 0.70919 ± 0.00002 | 0.72277 ± 0.00002 | 19.127 ± 0.008 | 15.775 ± 0.009 | 39.303 ± 0.029 |

**KZai 04** — latitude: 07° 40’ 20° S — longitude: 11° 48’ 90° E — water depth: 1228 m

| 2/11 (93 cm) | 0.70925 ± 0.00002 | 0.72181 ± 0.00003 | 19.264 ± 0.008 | 15.815 ± 0.009 | 39.471 ± 0.028 |
| 8/11 (769 cm) | 0.70917 ± 0.00002 | 0.72079 ± 0.00003 | 19.183 ± 0.008 | 15.788 ± 0.009 | 39.363 ± 0.028 |

**KZai 1** — latitude: 05° 42’ 18° S — longitude: 11° 14’ 09° E — water depth: 914 m

| 1/10 (92 cm) | — | — | 19.204 ± 0.009 | 15.781 ± 0.009 | 39.262 ± 0.029 |
| 10/10 (986 cm) | 0.70924 ± 0.00004 | 0.73444 ± 0.00002 | 19.277 ± 0.009 | 15.798 ± 0.009 | 39.349 ± 0.029 |

**KZai 11** — latitude: 06° 24’ 80° S — longitude: 05° 48’ 40° E — water depth: 4833 m

| 1/9 (61 cm) | — | — | 19.251 ± 0.010 | 15.830 ± 0.009 | 39.454 ± 0.030 |
| 9/9 (781 cm) | 0.70929 ± 0.00002 | 0.73240 ± 0.00002 | 19.108 ± 0.010 | 15.822 ± 0.009 | 39.767 ± 0.030 |

**KZai 6** — latitude: 05° 44’ 10° S — longitude: 08° 23’ 25° E — water depth: 4150 m

| 2/4 (140 cm) | 0.70922 ± 0.00002 | 0.73625 ± 0.00002 | 18.742 ± 0.009 | 15.788 ± 0.010 | 39.036 ± 0.029 |
| 3/4 (233 cm) | 0.70922 ± 0.00003 | 0.73122 ± 0.00002 | 18.552 ± 0.009 | 15.709 ± 0.009 | 38.351 ± 0.029 |

The number of centimeters in parentheses indicate location of sample on core from top.
L = leaches, R = residues and WR = whole rocks.
Whole rock Pb isotope analyses have been applied by several authors to sedimentary provenance studies and it appears that the Pb isotopic signature of the source is commonly preserved during sedimentation (Hemming et al., 1995; McDaniel et al., 1994). Moreover, the residence time of Pb in seawater being relatively short, the only source of natural pollution would be through local sources of Pb, connected for example to hydrothermal activity. None of the studied cores were taken in the vicinity of pock-marks which could have perturbed the geochemical signature of the sediments after their deposition (Gay et al., 2003). Furthermore, the Congo Basin is hardly industrialized and no anthropogenic Pb pollution is to be expected. Thus, the Pb information obtained on whole sediments mostly results from the chemical and mechanical weathering of the basin.

Sr isotopes are powerful geochemical tracer and have been widely used to characterise the provenance of sedimentary particles to the marine environment (e.g. Biscaye, 1974). The $^{87}$Sr/$^{86}$Sr ratio can be measured with high precision and is unaffected by transport processes and subsequent diagenesis (Dasch, 1969; Goldstein et al., 1984). However, the abundant seawater Sr precipitated in the marine carbonates greatly affects the $^{87}$Sr/$^{86}$Sr ratio of the whole sediment, and the provenance of the silicate component in sediment cannot be deduced by using the whole sediment: the $^{87}$Sr/$^{86}$Sr compositions of marine cores carbonates (i.e. leaches, Table 1) are close to 0.70918, the present-day seawater isotopic composition (Dia et al., 1992). Therefore, we report the Pb isotopic compositions of whole rocks (WR) and the Sr isotopic compositions of the carbonate-free residues (R).

4. Analytical methods

Sediments were available in the form of wet mud and sand. They were therefore washed twice with sub-boiled MilliQ water to avoid the influence of the major (Na, Mg, Cl) and trace elements (Sr) from inter-
stitial seawater. After drying, powders were homogenized using an agate mortar and leached with 0.5 N hydrochloric acid for 1 h to separate “carbonate” from “silicate” fractions (e.g. Asahara et al., 1995). Strontium is an important carbonate constituent, and has to be completely removed from the samples before any Sr isotopic composition on the “silicate” fraction can be obtained. To confirm the complete removal of authigenic component in the sediment and the insignificant effect of the HCl-leaching on the detrital component, we weighed the “solid before leaching” (SBL) and the “solid after leaching” (SAL) and compared the (SBL−SAL)/(SBL) ratio with the percentage of carbonate measured in these cores (unpublished Ifremer data). The results are in perfect agreement: for example, the KZ2-06 3/13 sample has a (SBL−SAL)/(SBL) ratio = 13.8% while the percentage of carbonate is close to 14%. The results obtained for the other samples are similar. A minor authigenic component (Fe–Mn oxide) and organic matter may be carried in the remaining residues (discussed in Asahara et al., 1995). However, Sr in Fe–Mn oxide does not affect the $^{87}$Sr/$^{86}$Sr ratio of the whole sediment because the modal abundance of such opaque minerals in samples is usually less than 1%. Sr in organic matter represents not more than a few percents of that in the whole rock, even in continental shelf surface sediments that have a high content of organic matter. The HCl-treated residues are consequently defined as the terrigenous component of the marine sediments.

The residues (i.e. silicates) were then dissolved in a mixture of hot sub-boiled HF/HNO$_3$. All acids were prepared by sub-boiling analytical grade reagents in all-Teflon® bottle-neck systems. Pb separation and purification were done on DOWEX® AG1-X4 resin using a 100 µl Teflon® column and appropriate eluting agents: 0.5 N HBr, 0.2 N HBr, 6 N HCl (after Manhès et al., 1978). Average total blanks for Pb chemistry were around 100 pg. Chemical separation of Sr was achieved using EICHROM® Sr Spec ion exchange resin. Elution with dilute HNO$_3$ and water separated Sr from other cations. Total procedural blanks for Sr were below 300 pg.

Pb isotopes were measured in static mode and Sr isotopes in dynamic mode on a VG Sector Mass Spectrometer. We used NBS 981 as Pb standard: the measured isotopic ratios of samples were corrected for mass fractionation with a value of $\delta_{\text{mean}} = 1.15\% _o \pm 0.10\% _e$/amu. Repeated NBS 987 Sr standard measurements gave a mean value of 0.71025 ± 0.00002 ($2\sigma_m$).

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Fig. 3. $^{206}$Pb/$^{204}$Pb in whole rock (WR) vs. $^{87}$Sr/$^{86}$Sr in residue (R) of analysed cores. Also reported are the present-day values of the suspended loads of the Congo River and its tributaries (Allègre et al., 1996; Négré et al., 1993): the so-called “Oubangui 1”, “Lobaye”, “Zaire”, “Sangha”, “Alima” and “Kasai” samples were collected just upstream of their junction with the Congo River whereas the C$_{64}$ represents the Congo River suspended load at Brazzaville (see Fig. 2). The horizontal stippled line underlines the Pb isotopic difference between marine samples with major sandy fraction and those having a dominant hemipelagic (i.e. mud) fraction.
5. Congo Basin isotopic signature

Previous isotopic results (Allègre et al., 1996; Négrel et al., 1993) provide an estimate of the Sr and Pb isotopic compositions of the major rivers particulate of the Congo catchment (Figs. 2 and 3). The main tributaries of the Congo River are the Oubangui River, the upper Congo River (“Zaire” sample), the Kasai River and the Likouala–Sangha River. The so-called “Lobaye”, “Zaire”, “Sangha”, “Alima” and “Kasai” samples were collected just upstream of their junction with the Congo River. “Oubangui 1” and “C64” were collected at Bangui and Brazzaville respectively (Négrel et al., 1993). The C64 sample was sampled a few km upstream of Brazzaville and is the best candidate to characterise the mean source of terrigenous sediment from the Congo Basin.

Compilation of published Sr isotopic compositions of basement rocks in central Africa reveals a very small number of analyses compared to the size of the drainage area (Fig. 2). These data are therefore only taken to be indicative of the average of the Sr isotopic composition of the respective areas.

6. Results and discussion

The isotopic signature of sediment is not only determined by the origin of the material (river source) but also by potential partitioning that may occur during sediment transport.

6.1. Congo and Ogooue rivers contribution

Sediments display a wide variation of Sr isotopic compositions from 0.721 for the samples from south of the Congo canyon to 0.765 off the Ogooue river (Table 1, Fig. 3). However all samples located in and around the present Congo canyon and deep-sea depositional system (KZai 1, KZai 11, KTZai 2 and 3) show clustered $^{87}$Sr/$^{86}$Sr ratios between 0.734 and 0.741. These values are close to the Sr composition of particulate fraction from the Congo River (C64: $^{87}$Sr/$^{86}$Sr = 0.7364, Négrel et al., 1993), which comforts the Congo River as the main source for the margin present-day sediments. The samples located on the upper slope off the Kouilou outlet (KZai 1) yield values close to those of the suspended sediments supplied by the Congo River (C64). Note that the KTZai 3C sample plots far outside this group, with unradiogenic Sr isotopic ratio, which suggests an artefact. This sample could unfortunately not be replicated and will not be considered further.

The central part of the Congo River catchment consists of Tertiary fluvial–lacustrine sandy formations (Cahen, 1954) (Fig. 2). These siliciclastic formations yield Sr isotopic ratios clustered between 0.7188 and...
0.7194 (Négrel, 1992), values which are significantly less radiogenic than those of the Congo River (C64) particulate fraction and of the present-day sediments. This result indicates that the present-day Congo River does not rework these Tertiary formations, but that it erodes formations with more radiogenic Sr (i.e. basement rocks) in its catchment. It also suggests that the main source of the present-day deep-sea fan is the basement rocks cropping out around the Congo catchment rather than reworked Cenozoic sediments from the central part of the Congo catchment. This is in agreement with the present morphological setting of the Congo drainage comprising a wide area of deposition in the central basin (Fig. 2). The absence of present erosion in the central part of the Congo catchment is supported not only by the preservation of fluvial–lacustrine sediments, but also by analyses of the particulate and alluviums of the Congo affluents (Giresse et al., 1990; Kinga-Mouzeó, 1986). These studies show that the silty and sandy fractions found in the Congo affluents are stable, and result from an older, hydrologically more active period.

The KTZai 1 core samples are clearly distinguished from all others by their high Sr isotopic ratios. The Sr isotopic data of this group exhibit a range from 0.7476 to 0.7657, compared to 0.7312–0.7415 for the other samples (Fig. 3). The same distinction is observed on Pb–Pb diagram (Fig. 4): the Pb isotopic data individualize this core, which presents the highest 207Pb/204Pb ratios. The significantly more radiogenic Sr values featured by these KTZai 1 samples could be correlated with the high Sr isotopic ratios of the Precambrian rocks underlying most of the Ogooué River drainage basin. The isotopic data from Ogooué catchment yield Sr ratios of 0.8651 for the Francevillian formation (Bonhomme et al., 1982) and 0.8158 for Proterozoic paragneisses (Feybesse et al., 1998). Considering that about 90% of the Ogooué catchment is underlain by Proterozoic basement (87Sr/86Sr ~0.81, [Sr] ~150 ppm) and 10% by younger (Mesozoic and Neogene) sediments with lower [Sr] content (87Sr/86Sr ~0.72, [Sr] ~30 ppm), the resulting average isotopic ratio for the catchment would be around 87Sr/86Sr ~0.80, a value much higher than that obtained on KTZai 1 core. Moreover, taking into account the prevailing northward long-shore drift, the present solid discharge of the Ogooué River, which is pushed northward, can hardly reach the KTZai 1 site. The northward longshore currents or the upslope bottom current (Séranne and Nzej Abeigne, 1999) that sweep the Congo plume could account for a radiogenic southerly flux, but at 585 m water depth, its fluxes is probably moderate. Another third candidate would be the small but numerous rivers of this coast (Nkomi, Nyanga) because they run on nearby Proterozoic basement, usually characterised by radiogenic Sr isotopic compositions.

As no isotopic data is available for the particulate fraction of the Kouilou River, it is not possible to compare them directly with the data from the present-day sediments of the slope (KTZai 2 and 3), in order to identify a possible Kouilou contribution. However, this river catchment extends on the Late Proterozoic paragneisses and Proterozoic basement. Therefore, a significant Kouilou contribution to sedimentation on the slope would be signed by 87Sr/86Sr ratio higher than that corresponding to the Congo catchment (~0.80, see paragraph above for approximate values). On the other hand, Sr isotopic values, close to both sediments from the slope off the Congo (KZai 1) and particulate from the river (C64), strongly support a dominant Congo source for the slope sediments sampled in KTZai 2 and 3 cores.

The present-day KZ2 sample (1/13) presents a Sr isotopic composition close to those of samples located in and around the present Congo canyon and deep-sea depositional system (KZai 1, KZai 11, KTZai 2 and 3). The less radiogenic Sr values of the older (i.e. deeper) KZ2 samples (Fig. 3) cannot be interpreted as a direct signature of a source other than the Congo, since the closest river catchments erode Proterozoic basement rocks, which would provide highly radiogenic Sr ratios (0.833–0.843, Djama et al., 1992). Only the upper reaches of the Kwanza catchment include much younger (Permian to Tertiary) sequences, with presumably less radiogenic Sr values that would lower the overall Sr isotopic ratio. Therefore, the recorded variable Sr isotopic compositions, including low values, could be explained by varying contributions from the Congo and the Kwanza Rivers. Such changes would be controlled by the fluctuations in the main oceanographic parameters during the Quaternary (Bonifay and Giresse, 1992; Giresse et al., 1982; Jansen et al., 1984; Van der Gaast and Jansen, 1984; Zachariasse et al., 1984). It is noteworthy that the Sr isotopic values of the older KZ2 samples are close to those of the Tertiary formations found in the western part of the Congo catchment (~0.72, Fig. 2), suggesting a possible contributing source.

All these results imply that the Congo represents the major source of present-day sediments on the margin and that the smaller coastal river catchments do not contribute significantly to terrigenous sedimentation. One main implication of the extension beyond 400 km of the Congo Sr isotopic signature within slope sediments is the important spreading of the Congo
plume over the canyon edge, while turbidite currents are transferred to the deep-sea fan within the canyon.

6.2. Partitioning during sedimentary transport

Sediments from the present-day active Congo channel (KZai 6) display Sr isotopic values close to those of the KZai 1, KZai 11, KTZai 2 and 3 core samples. Nevertheless, the Pb isotopic composition of KZai 6 samples strongly differs from KZai 11 (Fig. 4), although: 1 — both samples are taken from the same presently active turbiditic system (the former from the channel, the latter from the terminal depositional lobe) and 2 — the Sr results suggest a single sedimentary source (i.e. the Congo).

The Pb isotopic values of the C_64 sample reflect a mixing between all the Congo tributaries (Négrel et al., 1993, Fig. 4). All samples derived from the Congo (see above) that include a significant proportion of clay, display strikingly similar Pb isotopic signatures which are slightly more radiogenic than the particulate fraction of the Congo River (C_64). The sedimentary environment does not seem to differentiate Pb isotopic ratios: samples from the slope dominated by hemipelagic deposition (KZai 1, KTZai 2 and 3, KZZ-04 and 06) have about the same Pb isotopic signature as those from the distal turbiditic lobe (KZai 11). The Pb isotopic values of the KZai 6 samples from the active channel are the only ones that are significantly less radiogenic than C_64 (Fig. 3). Such Pb discrimination therefore suggests a sedimentary partitioning phenomenon across the slope and the deep-sea fan. The difference is not related to the lithology of the samples since turbidite sands of the distal lobe and hemipelagic fine sediments of the slope have similar Pb values, whereas the two sandy sediments from the turbidite system (channel and distal lobe) are very different in Pb isotopic composition.

Observation of fine sand from these two deep-sea fan core samples (KZai 6 and KZai 11) reveals that samples from the distal lobe (KZai 11) include a significant proportion of extremely fine (<10 μm) clay unlike sands from the channel (KZai 6). This suggests that the radiogenic Pb signature of the sediments is carried by the clay. Samples from the active channel correspond to sandy sediment that has been incrementally cleaned off the clay minerals by the multiple turbidite events that transit through the channel. This contrasts with the turbidites deposited on the distal lobes that have been emplaced during one event, thus preserving parts of the clays content. The analysis of the Congo tributaries provides a scheme of such hydrodynamic segregation of clay particles. Giresse et al. (1990) have shown that the varying bottom current velocity across the river accounted for varying chemical and mineralogical composition of alluvium. Similarly they showed an enrichment of the alluvium in shale during low water while high water levels yielded alluvium enriched in quartz sand. The morphological similarity of meandering rivers on the continent and turbidite channels on deep-sea fans has been recently related to comparable hydrodynamic processes (Turakiewicz, 2004).

7. Conclusions

Sr and Pb isotopic compositions are used to constrain the present-day sediment sources on the Equatorial western African margin, near the Congo estuary. The morphology of the present-day active turbidite system and the Sr isotopic compositions confirm that the samples located in and around the Congo submarine system are derived from one single sedimentary source: the Congo River. However, the results obtained on the core located in the northern boundary of the Congo River influence area show a very wide range of \(^{87}\text{Sr} / ^{86}\text{Sr}\) ratio, suggesting a mixing between material provided by the Congo River and a more radiogenic source probably provided by the small but numerous rivers of this coast.

The deep-sea fan core samples are clearly distinguished from continental slope core samples through their Pb isotopic compositions. We interpret these differences as reflecting the Pb isotopic fractionation during quartz-rich sand segregation which involves a separation from clay particles in the turbidite channel.

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