Late Pleistocene to Holocene Meandering and Lateral Migration of the Big Black River, Mississippi

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ABSTRACT

The Big Black River (BBR) in western Mississippi has an anomalous straight reach (ASR) near Edwards, Mississippi. The ASR is an obvious fluvial anomaly on maps and imagery as the BBR shifts from its general southwesterly flow to a west-northwest flow for about 6.5 km, before returning to its meandering southwesterly flow. Previous studies in the area are limited, with explanations for possible causes of the ASR including jointing and faulting. Neotectonic activity has not been supported by earlier tectonic geomorphic investigations. Geomorphic indicators of change within the BBR floodplain such as abandoned channels and ridge and swale topography suggest the river migrated to the west along the ASR. The timing of formation of the ASR was investigated using optically stimulated luminescence (OSL) and radiocarbon dating of floodplain and abandoned channel deposits. Six hand augered holes were sampled to a depth of approximately 5 meters. Four holes were sampled south of the ASR along a bearing parallel to the river and two oxbows/meander scars were sampled north of the ASR. OSL ages indicate Late Pleistocene sedimentation at the eastern most sampling site and Holocene sedimentation in the most western site. Lateral migration rates based on the OSL dates along the ASR range between 18.0 cm/yr and 19.2 cm/yr, and average 18.5 cm/yr. The OSL and radiocarbon dates coupled with the landforms in the adjacent floodplain near the ASR reveal lateral migration of the BBR to the west beginning in the Late Pleistocene.

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Late Pleistocene to Holocene Meandering and Lateral Migration within the Big Black River, Mississippi

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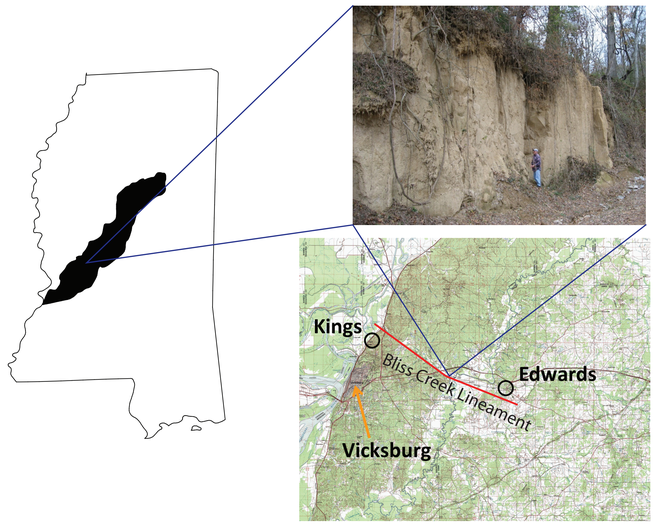
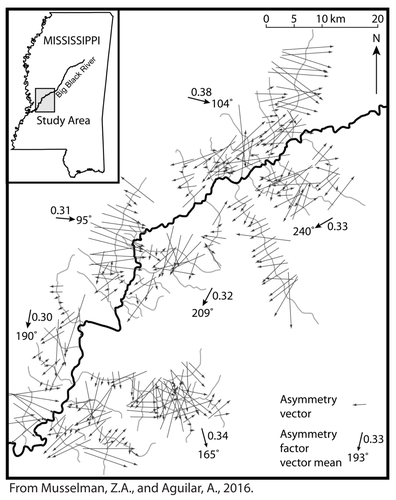
The Big Black River (BBR) in western Mississippi has an anomalous straight reach (ASR) near Edwards, Mississippi. The ASR is an obvious fluvial anomaly on maps and imagery as the BBR shifts from its general southwesterly flow to a west-northwest flow for about 6.5 km, before returning to its meandering southwesterly flow.



The Geology of the study area includes: Pleistocene loess, Catahoula sandstone (Upper Oligocene), and the Vicksburg group limestone (Lower Oligocene).

Previous studies in the area are limited, with explanations for possible causes of the ASR including jointing and faulting. Neotectonic activity has not been supported by earlier tectonic geomorphic investigations.

Ridge and swale topography and subtle terrace surfaces in the heavily agricultural study area.



From Musselman, Z.A., and Aguilar, A., 2016.

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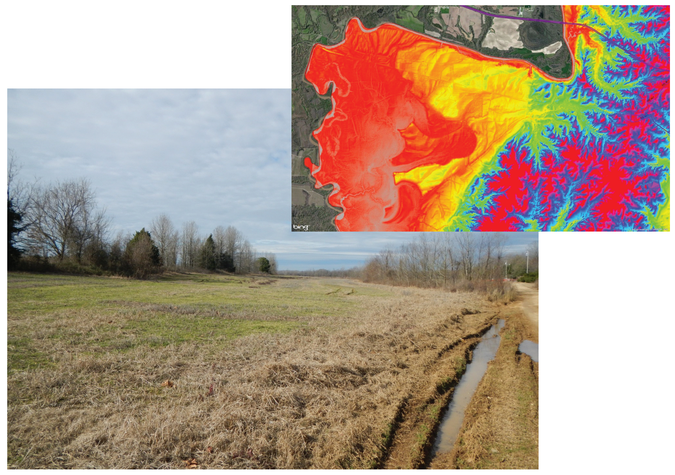
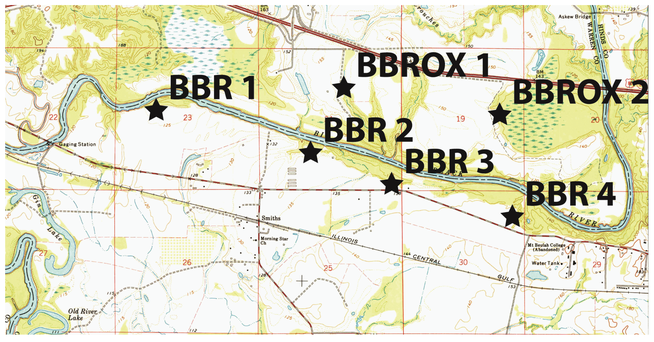
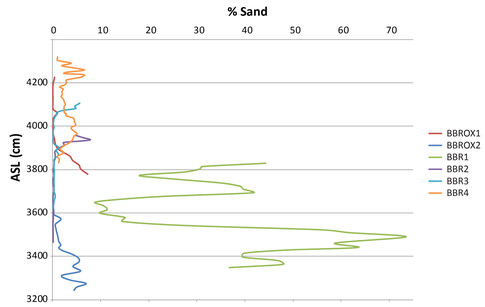


Geomorphic indicators of change within the BBR floodplain such as abandoned channels and ridge and swale topography suggest the river migrated to the west along the ASR.



The timing of formation of the ASR was investigated using optically stimulated luminescence (OSL) and radiocarbon dating of floodplain and abandoned channel deposits. Six hand augered holes were sampled to a depth of approximately 5 meters. Four holes were sampled south of the ASR along a bearing parallel to the river and two oxbows/meander scars were sampled north of the ASR.

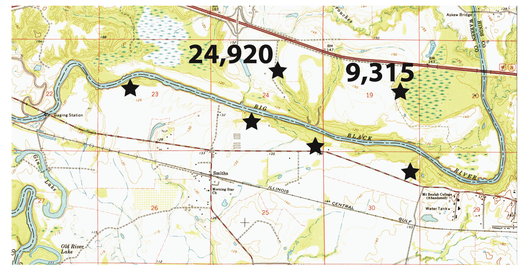
Samples from 2.5 m and 5 m depth at sites BBR1, BBR2, BBR3, and BBR4 were collected in aluminum core tubes and sent to the OSL Dating Lab (USGS) in Denver, CO. Two samples from BBROX1and BBROX2 were used to determine ^{14}C AMS.
All the samples collected were wet seived to determine percent sand content. Color was noted in the field. Magnetic susceptibility and organic Carbon content was determined for each sample.



All sites are dominated by mud, with the exception of BBR1. BBR1 is located in ridge and swale topography and represents more recent sedimentation.
There was very little variation in color in all the samples.
Magnetic Susceptibility spanned one order of magnitude and did not correlate directly with grain size or percent organic carbon content.

Sample	^{14}C age (uncalibrated)	^{14}C age (calibrated)
BBROX 1_425	20,830 ± 70	24,920 ± 117
BBROX 2_389	8,320 ± 30	9,315 ± 21

The ^{14}C dates were calibrated with Stuiver et al., 1998 and revealed ages similar to the OSL dates reported for the sites south of the ASR.



Sample information	% Water content	K (%)	U (ppm)	Th (ppm)	Cosmic dose additions (Gy/ka)	Environ. Dose Rate (Gy/ka)	Absorbed Dose (Gy)	n	Age (yrs)
BBR1_2.5m	9 (48)	1.54 ± 0.03	3.08 ± 0.11	8.81 ± 0.26	0.15 ± 0.01	2.31 ± 0.04	13.9 ± 0.31	23 (25)	6,010 ± 170
BBR1_5m	20 (50)	1.63 ± 0.03	2.87 ± 0.10	9.09 ± 0.27	0.11 ± 0.01	2.27 ± 0.05	19.6 ± 1.02	16 (20)	8,610 ± 470
BBR2_2.5m	26 (40)	2.10 ± 0.04	3.38 ± 0.12	10.9 ± 0.33	0.15 ± 0.01	2.71 ± 0.05	12.5 ± 0.65	17 (17)	4,630 ± 260
BBR2_5m	28 (54)	2.12 ± 0.04	3.09 ± 0.11	9.59 ± 0.29	0.11 ± 0.01	2.64 ± 0.06	50.5 ± 2.39	15 (15)	19, 130 ± 980
BBR3_2.5m	19 (48)	2.08 ± 0.04	3.22 ± 0.11	10.1 ± 0.30	0.15 ± 0.01	2.79 ± 0.05	33.1 ± 1.46	11 (11)	11,870 ± 570
BBR3_5m	27 (54)	1.89 ± 0.04	2.80 ± 0.10	8.74 ± 0.26	0.11 ± 0.01	2.39 ± 0.05	60.0 ± 1.08	17 (20)	25,100 ± 660
BBR4_2.5m	16 (50)	1.99 ± 0.04	3.17 ± 0.11	10.4 ± 0.31	0.15 ± 0.01	2.69 ± 0.05	7.98 ± 0.47	10 (11)	2,970 ± 180
BBR4_5m	27 (52)	2.09 ± 0.04	3.21 ± 0.11	10.4 ± 0.31	0.11 ± 0.01	2.71 ± 0.05	87.0 ± 4.35	2 (2)	32,105 ± 1,605

OSL ages indicate Late Pleistocene sedimentation at the eastern most sampling site and Holocene sedimentation in the most western site. Lateral migration rates based on the OSL dates along the ASR range between 18.0 cm/yr and 19.2 cm/yr, and average 18.5 cm/yr. The OSL and radiocarbon dates coupled with the landforms in the adjacent floodplain near the ASR reveal lateral migration of the BBR to the west beginning in the Late Pleistocene.