Eric Prokocki is currently working on a Ph.D. degree at The University of Illinois. His advisor is Dr. Gary Proctor. His research project is related to Holocene evolution and avulsion dynamics of the lower Mississippi River from St. Francis basin, AR, to the Tensas basin, LA.

The Overall Objectives of Proposed Study

River avulsion is defined as the abandonment of all or part of a fluvial channel belt in favor of a new advantageous course at a lower elevation on its adjacent flood plain (Allen, 1965; Slingerland and Smith, 2004). Avulsion is the first order process governing channel locations over short and long term time periods, and represents a large fraction of the total volume of sediment currently being deposited within incised fluvial valleys (Jones and Schumm, 1999; Slingerland and Smith, 2004; Aslan *et al.*, 2005; Stouthamer and Berendsen, 2007). Moreover, avulsion plays a pivotal role in the development of modern fluvial systems as well as the ancient stratigraphic rock record, yet our understanding of the physical processes governing avulsion remains limited (Slingerland and Smith, 2004). The lower Mississippi River (LMR) and the lower Mississippi Alluvial Valley (LMV) have played key roles in the development of many ideas in fluvial sedimentology; including concepts linked to avulsion (see Fisk, 1944 and 1951; Saucier, 1994; and Bridge, 1999). However, most research conducted on LMR avulsions and avulsions on other fluvial systems (*i.e.*, the Rhine-Meuse System) have focused primarily on its significance to delta lobe switching and the relocation of delta distributary channels. Where much less attention has been devoted to fully fluvial avulsions that occur in upstream locations far removed from the backwater affect and the delta region (see Saucier, 1994; Roberts and Coleman, 1996; Tornqvist *et al.*, 1996; Roberts, 1997; Bridge, 1999; Aslan *et al.*, 2005; Stouthamer and Berendsen, 2007; Edmonds *et al.*, 2009; Jerolmack, 2009).

Throughout the Holocene period, upstream LMR avulsions are often assumed to be driven entirely by autogenic processes (intrabasinal) (Bridge, 1999, and Tornqvist and Bridge, 2002), and not driven by allogenic controls (extrabasinal) on water discharge, sediment supply, and longitudinal channel bed slope. However, no comprehensive investigation of the absolute influence of both autogenic and allogenic mechanisms on promoting or limiting LMR avulsions exists. This is largely due to our lack of understanding of both the spatial and temporal evolution of LMR alluvial belts within the LMV during the Holocene. Significant advancement in our understanding of the evolution of Holocene LMR alluvial belts and the major processes controlling upstream Holocene LMR avulsions was obtained through a study by Prokocki (2010) within the Yazoo Basin of Mississippi. In this study, Prokocki (2010) used Optically Stimulated Luminescence Dating (OSL) to determine the timing of activity of four Holocene LMR relic alluvial belts located within the Yazoo Basin that were originally mapped and identified by Saucier (1994). The results of this study found that the interpreted upstream LMR interavulsion period (time between successive avulsions) within the St. Francis and Yazoo Basins during the Holocene was not constant, which supports the results published by Berendsen and Stouthammer (2007) on the Holocene Rhine-Meuse fluvial system. Berendsen and Stouthamer (2007) suggested that if the interavulsion period is not constant than the major factor contributing to the timing of successive avulsions is not autogenically derived. Furthermore, Prokocki (2010) found that the timing of the initiation of upstream Holocene LMR avulsions also did not correlate well with known allogenic processes such as large scale climate fluctuations, and flooding events. Prokocki (2010) also found that all interpreted upstream LMR avulsions within the St. Francis and Yazoo Basins did correlate well with rapid rates of sea-level rise during the Holocene within the Gulf of Mexico from ~ 9 ka to 4 ka. This line of evidence led Prokocki (2010) to suggest that rapid rates of sea-level rise are likely the major driving force causing upstream LMR avulsions during the Holocene. However, in order to better understand the Holocene evolution and avulsion dynamics of upstream regions of the LMR, a more comprehensive understanding of both the timing and spatial distributions of LMR alluvial belts from the St. Francis to Tensas Basins within the LMV is needed.

Therefore, the main hypotheses/objectives of this research are (a) develop a revised chronological framework for the Holocene meander belts in the Tensas Basin, LA using seven recently collected Optically Stimulated Luminescence dates (OSL), (b) correlate the OSL dates acquired from the Tensas Basin LMR alluvial belts with nineteen OSL dates obtained from the Yazoo and St. Francis Basin alluvial belts in order to correlate in time and space all upstream LMR alluvial belts from the St. Francis Basin to the Tensas Basin (Fig. 1), and (c) determine the frequency and timing of Holocene upstream LMR avulsions from the St. Francis to Tensas Basins according to the time of activity for each meander belt dated. Once the timing and frequency of LMR avulsions is documented, then the following questions can be more appropriately addressed:

1. What is the relative importance of allogenic processes (i.e. Holocene sea-level rise, and climatic fluctuations) on promoting or limiting LMR upstream avulsions?

2. How do localized stratigraphic (*i.e.*, Pleistocene LMR gravel/sand deposits) and geomorphological controls (*i.e.*, incised valley geometry) affect the timing, frequency, and spatial location of upstream LMR avulsions?

3. How do very large incised fluvial valleys (i.e. LMV) fill with sediment in time and space during sea-level rise and sea-level highstand?

Update on Progress of Proposed Study: Jan. 2012

Seven OSL samples were recovered from the Yazoo (2 samples) and Tensas Basins (5 samples) during a field research campaign conducted in the Lower Mississippi River Valley (LMV) in June/July of 2010 (see Fig. 1 for general locations). These samples were pre-processed (optimal grain size recovery via wet sieving – 180 to 250 microns) in the Illinois State Geological Survey Optically Stimulated Luminescence Laboratory in August of 2011. It was determined during sample pre-processing that one of the Yazoo Basin samples would not be sent to be officially dated, thus leaving six official samples that met the minimal criteria needed for full laboratory dating analysis (1 sample – Yazoo Basin, 5 samples – Tensas Basin). Furthermore, the laboratory dating analysis for six OSL samples collected from the St. Francis Basin were received in August of 2011. These OSL dates were then plotted against the previously recorded dates from the Yazoo Basin (Fig. 2). From Figure 2, it is clear that the spatial and temporal distributions of Holocene LMR alluvial belts are being uncovered. Therefore, once the laboratory analysis of the six newly collected OSL samples is completed, a connection in time and space will be achieved for the Holocene LMR alluvial belts from the St. Francis Basin to the Tensas Basin. Once the Holocene LMR alluvial belts are connected in time and space, the timing, frequency, and spatial locations of upstream LMR avulsions can be interpreted.

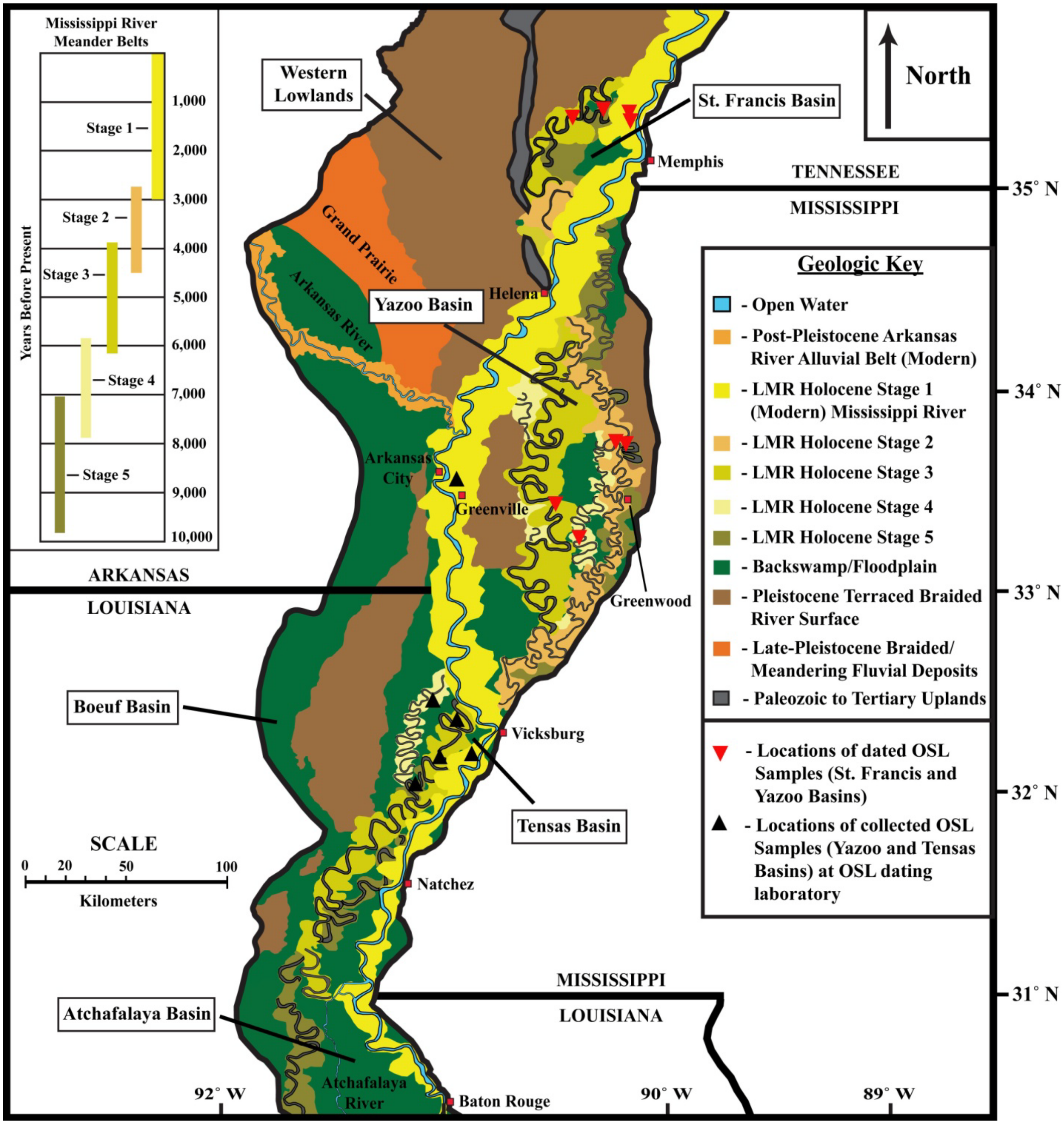

Figure 1. *Map of the Lower Mississippi River Valley (LMV) from the southern St. Francis Basin to the Atchafalaya Basin. Depicted in this map are the locations of OSL samples that have been dated (red triangles), and the locations of recently collected OSL samples that have been submitted for official laboratory dating analysis (black triangles) from the Yazoo and Tensas Basins. Modified from Saucier (1989).*

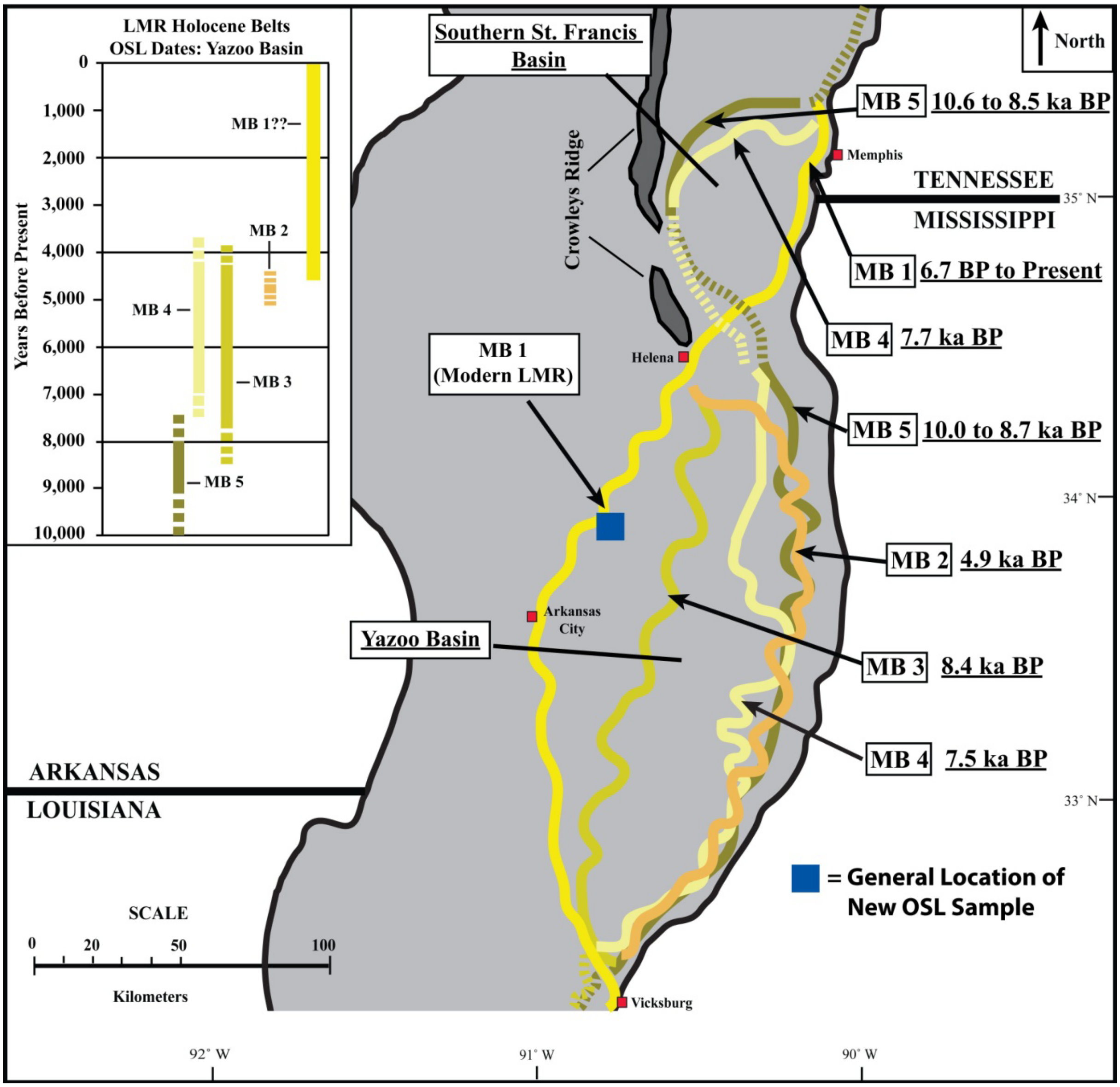

Figure 2. *Schematic diagram of LMV from the southern St. Francis Basin to the southern edge of the Yazoo Basin displaying: (a) the general spatial locations of Holocene LMR alluvial belts, and (b) the timing of activity of these determined alluvial belts. Included is the location of a recently collected OSL sample within the Yazoo Basin that has been submitted for laboratory dating analysis (blue square). Modified from Saucier (1989).*