Monday, March 18, 2002

Westchase Hilton • 9999 Westheimer
Social 5:30 p.m., Dinner 6:30 p.m.

Cost: $25 Preregistered members; $30 Nonmembers & Walk-ups

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International Explorationists Dinner Meeting

by M. J. Wilkinson,[1] N. R. Cameron,[2] and K. Burke,[3]

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Global Geomorphic Survey of Large Modern Subaerial Fans: Distribution and Exploration Implications

Large modern fluvial fans are partial cones of sediment, each fan generally formed by a single dominant river. These features display gentle slopes (compared with small alluvial fans) and their apices are tied to mountain fronts or low scarps. Large fans are mesoscale continental sedimentary systems (radii arbitrarily defined as >100 km) barely recognized in geological literature, mainly because they are not readily visible on the ground or from low-altitude photographs because of their great size and gentle slopes. Space Shuttle and International Space Station photographs, supported by 1:1,000,000 maps, reveal basinal geological settings with relatively young sediments and distributary drainage in many parts of the world, leading to the identification of 96 large fans. Large fans appear on all continents between 55°N and 55°S, which constitutes our survey area. Fan areas range between ~7000 and 210,000 km^2. Most radii (90%) fall between 100 and 300 km. Fifty-eight percent lie in foreland and peripheral basins; 39% lie in cratonic settings. The remaining 3% occur in rifts and intra-orogenic settings. Asia displays the largest number of modern large fans and North America the smallest number. Large areas of nested fans occur in Australia and Africa. The largest group of contiguous fans occurs in South America, from northern Bolivia to central Argentina where the basin between the Andes Mts. and the Brazilian craton is entirely occupied by seventeen fans, covering ~750,000 km^2. Large fluvial fans are thus a significant feature of the global landscape, and probably have been so throughout much of Earth's history.

Understanding the distribution of large modern fans may help direct exploration for such features in past landscapes. Large modern fans may also provide models for detailing the architecture of paleo-fluvial reservoir systems. For example, the early Paleozoic oil and gas reservoirs of North Africa accumulated in settings which may have been analogous to the modern foreland basins of Central Asia and India. The large fan analog may also prove appropriate for the Witwatersrand basin of South Africa.

Biographical Sketch:

JUSTIN WILKINSON trains astronauts in earth science and geography at the Johnson Space Center in Houston and conducts research using Space Shuttle photos. Born in South Africa he obtained his Bachelors (with honors) and Masters degrees in Physical Geography from the Johannesburg University. After a year as Chairman of the South African Voluntary Service, which built schools and clinics in rural communities in and around South Africa, he came to the USA in 1976 to the University of Chicago for doctoral study. His dissertation on landscape evolution and uranium mineralization in the central Namib Desert has been published in book form. After three years teaching geography back at his alma mater in Johannesburg (1985-1988), and after becoming a US citizen in 1987, he immigrated back to the USA to take a position training astronauts in earth science and geography at the Johnson Space Center in Houston with Lockheed Corporation.

Justin's recent work on a new database of Space Shuttle photos has resulted in a series of research initiatives—on inland deltas worldwide, involving travel to South America; on fish evolution dynamics (related to inland deltas); and on worldwide dust movement and dust sources. In addition, Justin co-authored the book "Orbit" with astronaut Jay Apt, a coffee table collection of Space Shuttle photos of the Earth. Justin Wilkinson is the main author on a new book, "Costa Rica From Space", due to be launched in Costa Rica in April this year. □

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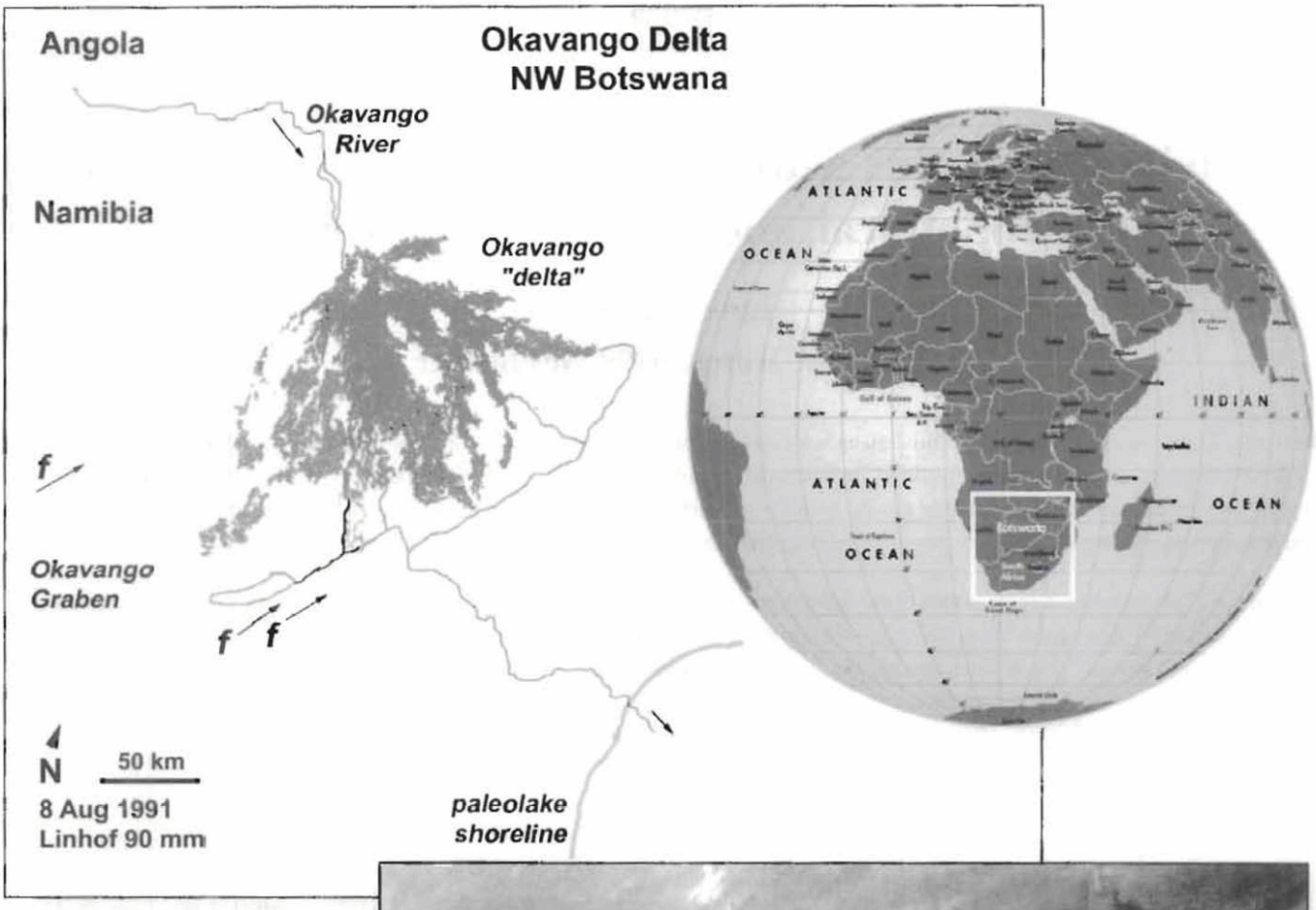

The densely forested distributaries of the Okavango Swamps, also known as the "jewel of the Kalahari Desert," appear dark green in this Space Shuttle view of semiarid northwest Bostwana. The swamps constitute a large fan within the Okavango Graben, an extension of the East Africa rift system. The 150 km radius of the fan is determined by the distance between faults at the apex and the toe (arrows). Major mountain fronts are not the only environments in which large fans form. Low fault scarps such as that at the Okavango Swamp apex (only ~5m) are also sufficient to allow rivers to avulse through a wide angle to form large fans.

The Okavango River, reflecting the sun, enters the megafan apex from the high-rainfall Angolan plateau. In world terms, the fan is unusual for its size, its swampy nature and existence within a rift. Numerous fires in the thicker Angolan savannas appear top left in this oblique, northwest-looking view. □