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## Structural Trap Styles of Recent Large Gas Discoveries, Tarim Basin, Western China

The Tarim Basin is one of several blocks or “microplates” which together compose the Asian continent. Central and southern Asia was formed by the successive accretion of these microplates to the Siberian craton. The general sequence of accretion proceeded from north to south, beginning with the suturing of the Tarim and Junggar blocks to the Siberian craton in the Permian, and ending with the docking of India along the southern margin of Tibet in the late Tertiary. The mountain belts that presently surround the blocks represent a complex variety of plate margin and island arc terranes that were deformed during the suturing process.

The Kuche Fold and Thrust Belt (KFTB) forms the 250-km-long central segment of the nearly 1000-km-long deformed northern margin of the Tarim Basin in western China. The primary transport direction on major thrusts is from north to south. Deformation in the Kuche area affects a 12,000-m-thick Mesozoic and Tertiary section composed primarily of conglomerates, sandstones, shales, coals, and evaporites deposited in near-shore, alluvial and lacustrine settings.

Seismic and outcrop data indicate two major periods of structural growth in the KFTB. The first occurred at the end of the Cretaceous, as evidenced by a top Cretaceous erosional unconformity, and the depositional thinning and onlap of base Tertiary units on the flanks of thrust-cored folds. Another occurred during the late Tertiary, as evidenced by the depositional thinning of Neogene units across fold crests. Recent earthquakes and offset gravel terraces also indicate presently active north-south shortening in the KFTB.

The deformed section in the KFTB can be subdivided into at least four tectonostratigraphic units. The regional basal detachment occurs in lower Triassic shales. Another important detachment is in a salt horizon at the base of the Tertiary. A Miocene salt horizon, depositionally restricted to the eastern KFTB, is the locus of

another detachment in this part of the belt. Where they can be clearly observed in outcrop, supra-salt folds are often box-shaped, with varying sense of vergence from fold to fold, and along strike on a single structure.

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Commercial hydrocarbon exploration and production in the KFTB dates to combined Chinese and Russian efforts in the 1950s. A few small, shallow oil and gas fields were found. Declining production in eastern China spurred the current phase of exploration activity by PetroChina in the KFTB, beginning in the early 1990s. The main targets now are the deeper, thrust-associated folds below the salt detachments. This has posed several challenges, including accurate seismic imaging of complex structures below salt and drilling through thick salt into highly over-pressured sections. Despite these difficulties, one 6-to-8-Tcf field has been found (dry gas, methane content >98%), and two or more with potentially similar reserves are being tested. PetroChina has just completed construction of a 4200-km pipeline to transport gas from the KFTB fields to Shanghai to supply growing markets in eastern China. ■

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### Biographical Sketch

DR. SANDRO SERRA is a consultant specializing in structural geology. He received a BS from City College of New York (1970), MS from Syracuse University (1973) and a PhD from Texas A&M University (1978). He has worked in the upstream oil and gas industry for over 25 years. During his tenure at Amoco and BP (1977–2003), he has worked with many teams in a variety of structurally complex areas. His expertise is predicting and determining the geometry of structures at both regional and prospect scales using a variety of approaches and tools. He is an Associate Editor for the *AAPG Bulletin*, and a member of the HGS, AAPG and GSA.

