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**Journée Scientifique
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Biodiversité, Stratigraphie, Paléogéographie Paléo-environnements, Paléoclimats, Géo-ressources du Jurassique

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Jurassic geodynamics and hydrocarbon potential of western Central Asia: the case of the Amu Darya Basin

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Jurassic deposits hold a substantial part of source and reservoir rocks of the world's hydrocarbon giants fields. In western Central Asia, Jurassic carbonates of the Amu Darya Basin host the second largest gas field: Galkynysh (consisting of a cluster of fields, Iolotan, Minara, Osman and Yashlar) as well as a number of other gas and oil fields mainly located on its northeastern margin (Fig. 1).

The NW-SE elongated Amu Darya Basin containing more than 15 km of sediments has been formed by two main extensional events and affected by compressive events due to the collision of the Cimmerian terranes (Fig. 2). After a strong Late Paleozoic-Triassic extension, a NE-directed Early to Middle Jurassic extensional event shaped chiefly the eastern half of the basin, establishing the basin content with an active phase of subsidence. The Early to Middle Jurassic syn-rift siliciclastics deposited in continental humid conditions then marine environment, when the basin was settled in temperate latitudes. The presence of coal, at least on the northeastern margin, attests to a probable good source rock (Fig. 2).

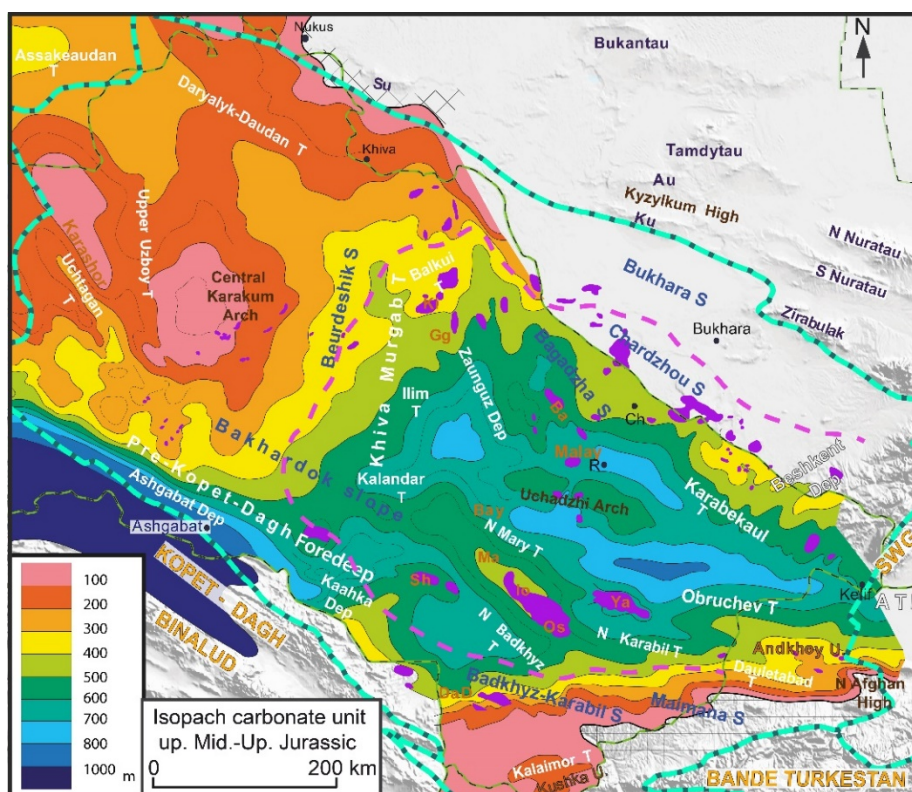


Figure 1: Isopach map of upper Middle-Upper Jurassic carbonate unit represented mainly in Turkmenistan; dashed pink line: boundary of salt in the Gaurdak Upper Jurassic Formation; purple areas: main oil-gas fields inside the Callovian-Oxfordian carbonate reservoirs sealed by the Gaurdak evaporites (after Brunet et al., 2017). Blue green line with black dots: contour of the Amu Darya and Afghan-Tajik basins; green lines with black dashes: political boundaries.

ATB: Afghan Tajik Basin; Au, Auminzatau; Ba, Bagadzha swell; Bay, Bayramali field and swell; Ch: Chardzhou town; Dep, Depression; DaD, Dauletabad Donmez field and high; Gg, Gagarin field and swell; Io, Iolotan field and swell (= part of Galkynysh); Ki, Kirpichili swell; Ku, Kuldzhuktau Mts; Ma, Mary-Serakhs uplift zone; Os, Osman field and swell; R, Repetek town; S: Step; Sh, Shatlyk field and swell; Su, Sultanuzdag Mountains; SWG: South Western Gissar; T, Trough; U, Uplift ; Ya, Yashlar field and swell.

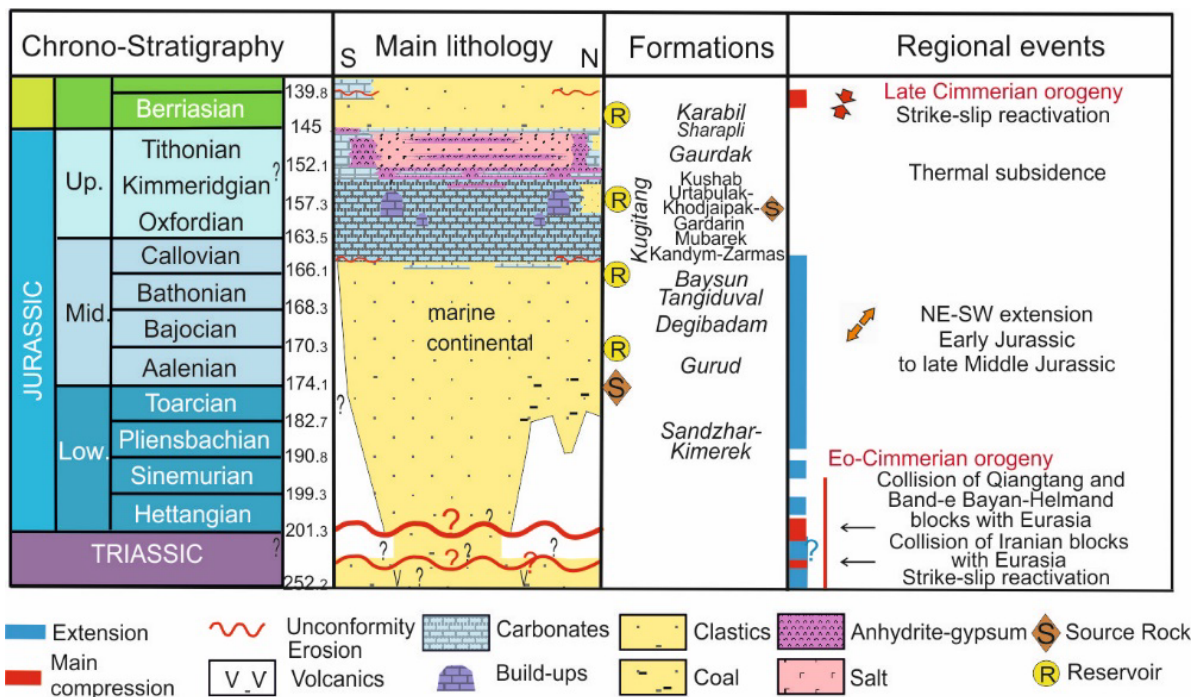


Figure 2 Synthetic lithostratigraphic column of the Amu Darya Basin for the Jurassic, highlighting main unconformities and tectonic events (after Brunet et al., 2017 modified). The lithologies are simplified into clastics, carbonates and evaporites. Some names of formations of the Bukhara-Khiva and Murgab regions are indicated. Possible hiatus are only displayed for the Triassic to Middle Jurassic.

By the end of the Middle Jurassic, the combination of a more quiet thermal subsidence, the levelling of the hinterland, the progressive moving of the area in lower latitudes and climate changes allowed establishing a carbonate sedimentation. Wide shallow carbonate platforms and reefal build-ups developed on the margins in warmer and more arid environments. The best reservoirs take place in these carbonates as well as a second potential good source rock: the Khodjaipak Formation (Fig. 2). This thin 10 m-thick organic rich Oxfordian level is known by wells on the northeastern margin of the basin and outcropping in only two places. The Late Jurassic ends with the thick evaporites of the Gaurdak Formation, filling the Amu Darya depression and providing a primary excellent seal with salt, anhydrite and gypsum on the margins. Their deposit was permitted by the tectonic almost isolation of the basin and the situation of the basin in arid zone latitudes.

Thus, plate tectonics, pole moving, climate and sea-level changes as well as regional tectonics created favorable conditions for a complete prolific Jurassic hydrocarbon system in the Amu Darya Basin with two possible source rocks, several levels of reservoirs and an evaporite seal.

References:

Barrier E., Vrielynck, B., Brouillet J.F. & Brunet M.F. (Contributors : Angiolini L., Kaveh F., Plunder A., Poisson A., Pourteau A., Robertson A., Shekawat R., Sosson M. and Zanchi A.) 2018.- Paleotectonic Reconstruction of the Central Tethyan Realm. Tectono-Sedimentary-Palinspastic maps from Late Permian to Pliocene. CCGM/CGMW, Paris, <http://www.ccg.org>. Atlas of 20 maps (scale: 1/15 000 000).

Brunet, M.-F., Ershov, A.V., Korotaev, M.V., Melikhov, V. N., Barrier, E., Mordvintsev, D.O. & Sidorova, I.P. (2017). Late Palaeozoic and Mesozoic evolution of the Amu Darya Basin (Turkmenistan, Uzbekistan). In: Brunet, M.-F., McCann, T. & Sobel, E.R. (eds), Geological evolution of Central Asian Basins and the western Tien-Shan Range. The Geological Society, London, *Special Publications* 427, 89–144. <https://doi.org/10.1144/SP427.18>