Considerations on the bottom topography of western trough of Aral sea.

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Attention has not be yet carried attentively to the bottom morphology of the western basin of Aral, which attains the depth of –16m under general sea level. This deep corresponds to a graben[1] located between the UstUrt plateau on the west and the horst of Lazarev-Vozrojdenie islands on the east (see fig.1, taken from I.V.. Rubanov,p.39). This " horst" may be followed southwards to the Sultan Dag heights, SW of Nukus, under tertiary and quaternary beds.

Under a cover of quaternary fluvial sediments, boreholes for gas and oil have found the same almost horizontal tertiary and cretaceous beds which form the western cliff(the " Chink", and the Lazarev-Vozrojdenie-Kulandy "horst".(+93 m asl.). This infrastructure was acquired at the end of the tertiary era, a few millions years ago, and during the pliocene and early quaternary times, the Syr darya river carved its valley from the NE of Aral SWwards along the NS graben, while brooks descended westwards from the Vozrojdenie highs to the main course, as is attested by the western topography of the horst (fig.2).

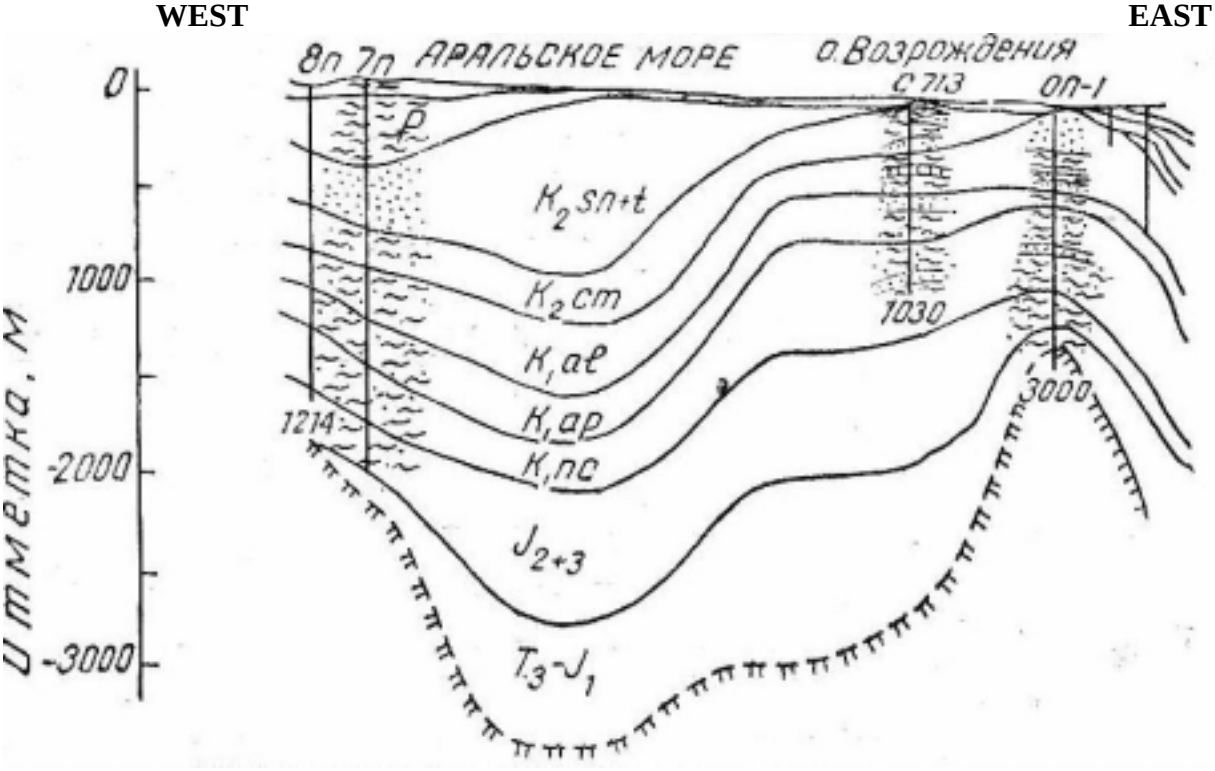

Fig.1: schematic geological profile of Aral sea, from Rubanov, with position of cores .

[1] A graben is a trench the limits of which are faults separating lowered geological beds from uplifted ones; a horst on the contrary is a upheaved section between two faults.

When the whole depression of Aral, in great part carved by wind erosion during glacial episodes, then filled by alluvions deposited by the Palaeo-Amu Darya and Palaeo-Syr Darya, quaternary , lacustrine sediments began to recover the past subaerial topography. The essential part of these sediments is made of sand and silt, carried by the two big rivers, especially during high waters (as energy of carrying water is greater at that time).

Very few data exist as concerns the thickness of the quaternary sedimentary cover, which is maximal in the deltas, and minimal in Vozro-Kulandy straits or past Berg straits (the place of the modern dyke between Little and Big Seas). There are no published data, except those given by Rubanov (1987), who did not reach depths over 4m. In an unpublished core of the 2002 french expedition, some 20 km north of Ushay, the past port of Nukus, supposed Neogene (N2) substratum was reached at a depth of 12 m but no sedimentological studies have been yet made on this core Lecallonnec, (pers. com.).

Little attention has been drawn on the morphology of past palaeo-thalwegs (valleys) at the bottom of Aral Sea, which were drowned when Aral Sea level was at its historical level of 53-56 m asl. The german map with its meter-by meter hypsography (fig.1) for the first 20 m depth, and with a little less precision,(2 m then 5m) for deeper waters, permits to draw the longitudinal profile of past channels from the Amu Darya, when most water of this river was diverted to SaryKamysh.

The two most conspictuous profiles are given on fig.2.

Here we have to recall a few principles of sedimentology about the transportation of particles by rivers as a suspension and their sedimentation. When the energy of the particles, due to running water , falls below a certain limit, they fall onto the bottom . When water from the river reaches the lake, their energy does not depend any more from the running water energy, but only on gravity (and eventually on lake currents), and they settle, forming a " alluvial underwater fan", with a very low slope on the up-river side, much steeper on the lake-side. (Fairbridge, ed. Encyclopedia of Geomorphology, Reinhold, N.Y, 1968)

The western channel shown on fig.2 is known to have been functional in the middle Ages (fig.3, taken from Yagodin:Cahiers d'Asie Centrale,11-50,2002)- but not the eastern one -, and three " breaks" appear on the profile before it reaches the bottom of western basin. The mean slope is very low, about 3.10^{-4} , but with variations from 0.4 to $6.6.10^{-4}$, distributed regularly , since Sudoche lake up to the Aral bottom, 200 km in the North . This suggests a succession of three successive alluvial fans, the upper one being evidently the sub-actual one, the deepest being perhaps the oldest. In the absence of other data it is not possible to give a possible chronology of these assumed alluvial fans.

The eastern channel (right one on fig .2), going to the south-eastern basin, only shows the upper fans, as the base level is much higher,and this part of the lake was completely dry when water went on arriving to the western basin.

A synthetic profile of the succession of terraces briefly described by authors around the Aral shores is given on fig 4.. The deepest terraces have not been thoroughly studied, as most were drowned until the last years. The lowest (Paskevitch) “terrace” could correspond to the deepest inflection of the Amu Thalweg presented on fig.2.

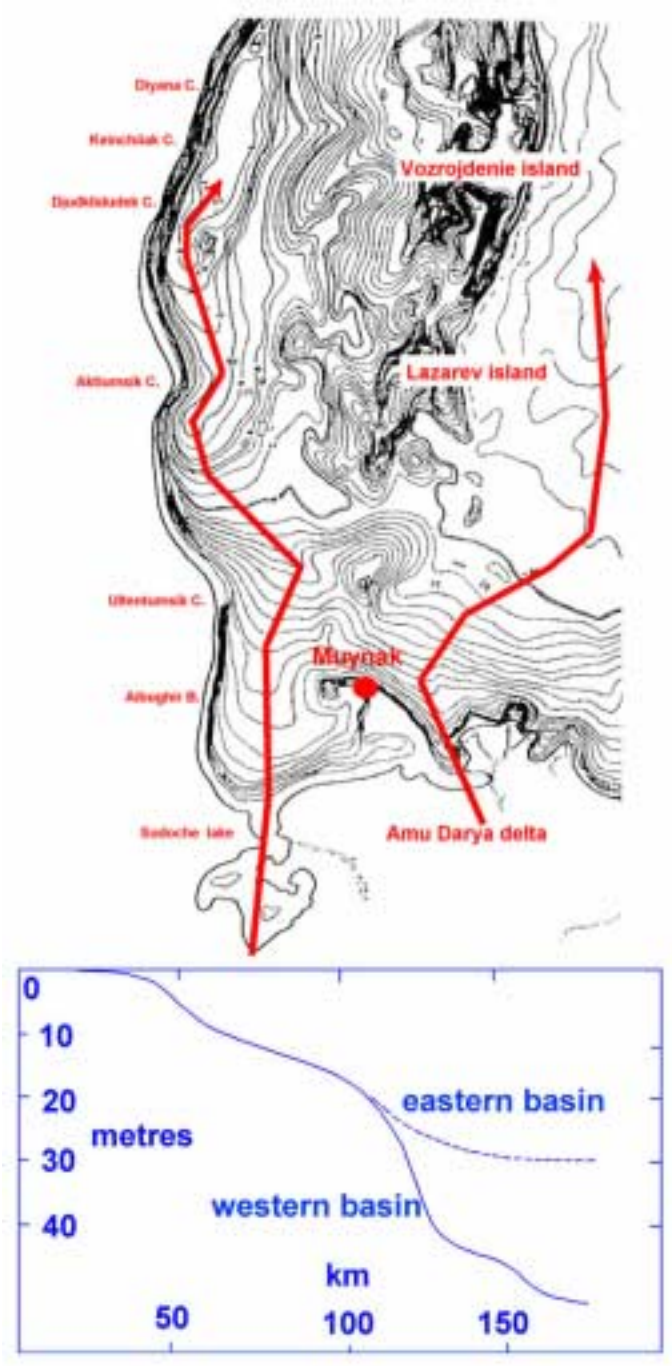

Fig.2 : Bathymetry of SW Aral with (in red) the bottom of Amu Darya thalweg. Morphology of thalwegs in Eastern Aral basin may be inferred from “ humidity tracks” on infra red NOAA satellite pictures (Smis-Iki almost daily documents)

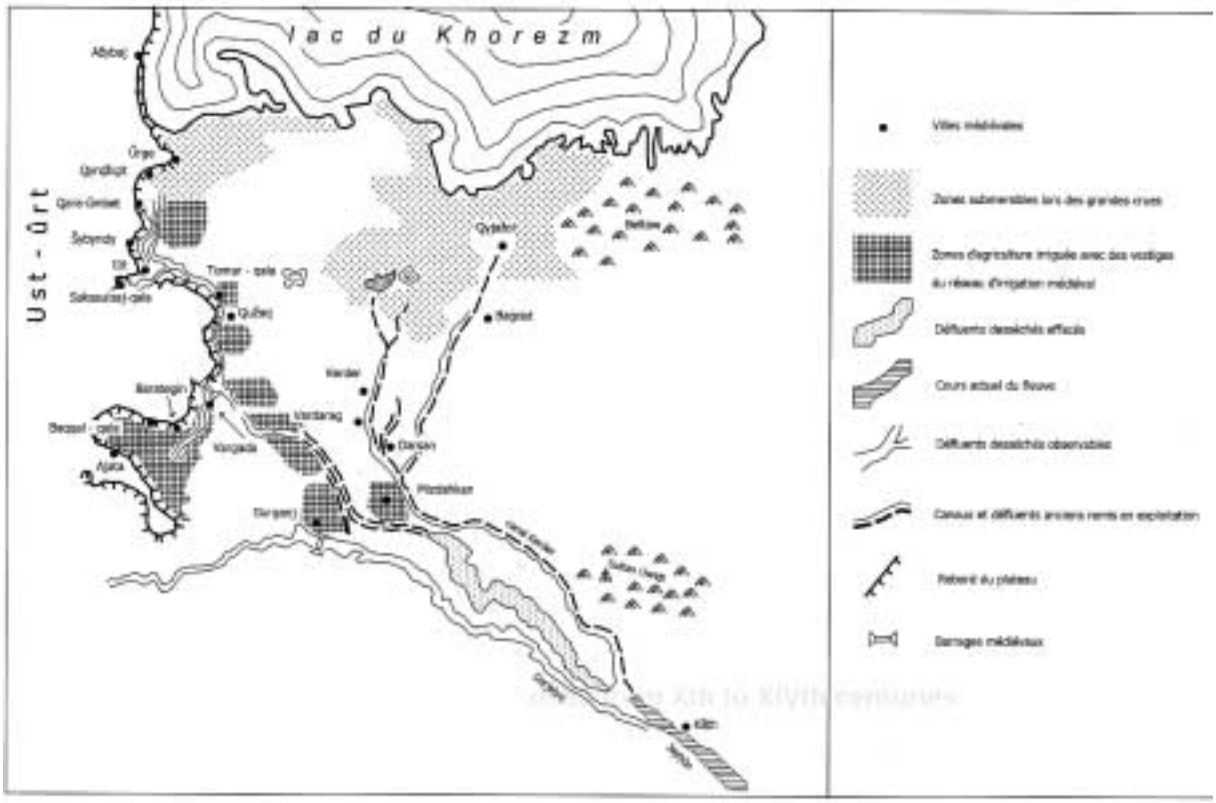

Fig.3 : from Yagodin, 2002.

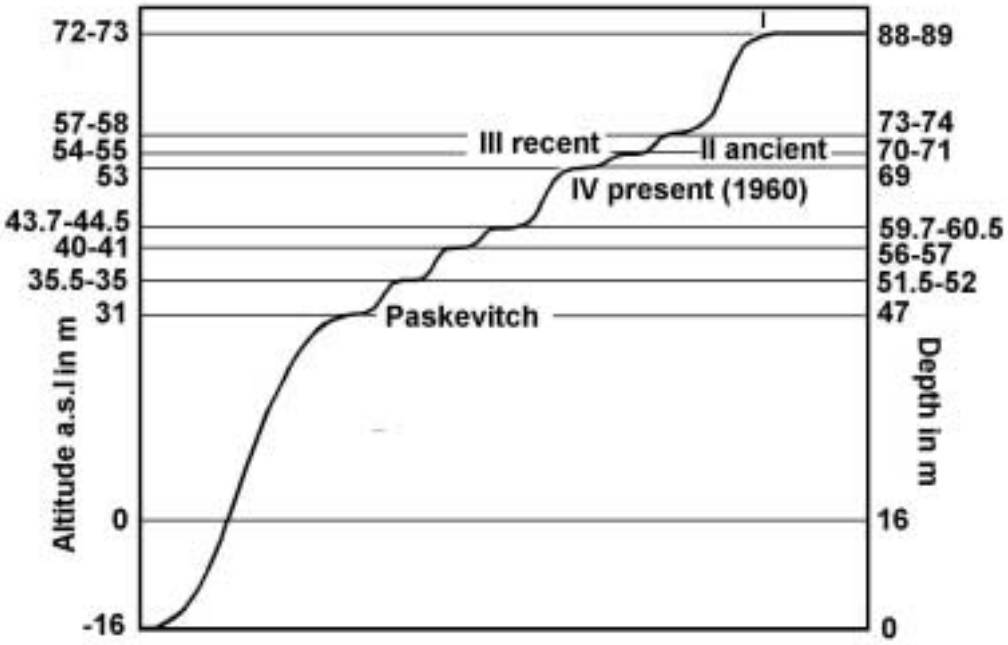

Fig.4: Synthetic profile of Aral terraces (from Aladin et al.).