DRIDU STORAGE - THE COLMATAGE EVOLUTION

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***Abstract*:** Dridu lake storage, situated on the Ialomița River, upstream the confluence with the Prahova River, having 2,300 km^2 surface, has inevitably suffered a process of colmatage. This process began in 1986 after the lake storage had been put into service.

The colmatage process is passing its first stage even though Dridu lake storage that is situated in a plain, on Ialomița River (inferior) course. The colmatage is achieved by the river deposits that are carried by the Ialomița River and stored in the lake storage (between 30 kg/s middle delivery and 10,000-15,000 kg/s when there is a water high), but also by the material coming from the banks landfall. The Ialomița River brings the greatest part in the colmatage process. Since 1996, through bathymetry measurements, it has been determined the degree of colmatage, its rhythm, the way the deposits are set into the lake, the colmatage evolution till today and the possibility of turning the data for this process` prognosis into something valuable. As it was shown before, the colmatage is passing its first stage. This statement is supported by the following: relative small percentage of the colmatage, 18,6 % (according to the measurements taken in October 2001); deposits are relatively uniform, occupying mainly the end of the bask water; diminishing the initial dishevelment either of the river bed, or those remaining from the site; washing the alluvium deposits in the first part of the lake, upstream the barrage (the washing process being much more intense in this part of the lake than the colmatage process).

What will follow? Certainly, the inevitable colmatage process will continue, having (bigger) more or less forces (intensity), depending on the water high abundance. The upstream half lake will be affected (from the end of the backwater), on its central part and then its lateral parts and the bays. The way the deposits are collected will be conditioned by the general configuration of the lake, by the advance direction, by the streams forming in the lake, by the shuntings executed on it. An important role will be held by the vegetation that will occupy the lateral parts, the bays or the parts already colmataged. The vegetation will hurry the deposit. The lateral landfalls should not be neglected either. They do not offer large amounts of deposits but they also modify the morphology of the lake. The lake streams, especially those created by the specific working shuntings can wash the first half of the lake diminishing the colmatage rhythm.

Though it is a slow process, the colmatage will gradually lead to the Dridu lake storage ageing, this hydrotehnic organism always transforming.

The Dridu storage is located on the Ialomita river, at 2300 Km^2 basin area, on the plain area, upstream the junction with the Prahova river. Put into service in 1986, it stores its volume on 11 Km length, between the old banks and the old major streambed of Ialomita river, having in width 300m - 1400m. The cuvette morphology has a trapezium shape, 10m height from the lowest area up to 69,2m.

The colmatage process, started after the storage has been put into service (1986) is done with river deposits stored into lake (30 Kg/s on yearly discharge and 10.000-15.000 Kg/s on high water).

From 1996, through bathymetry have been established the colmatage degree, it's rhythm, the way of alluvium sediment is deposited into the lake cuvette, the colmatage evolution until today and the possibility of using available data for the process prognosis.

Because of its particularities in the cuvette morphology, the Dridu storage has been divided in:

- **Entire storage** representing all the cuvette up to 69,2m (NNR), starting from the Micsunestii Mari bridge to the barrage. It is the projected storage, with natural riverside morphology and dikes up to 71m. For a good documentation, the entire storage was covered with transversal profiles (19), on which is periodically executed bathymetry and topometry.

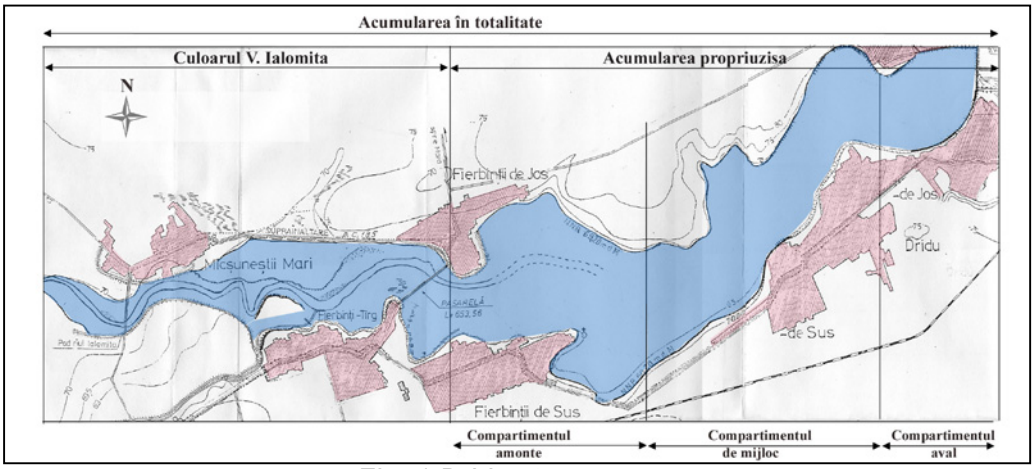


Fig. 1 Dridu storage map

- **Proper storage** representing the lake cuvette, always covered by water – less than 67 m in altitude. It is more then a half of total storage from Fierbintii de Jos dike to the barrage. For a good orientation, proper storage was divided in:
  - Upstream compartment – end of backwater, which is located between Fierbintii de Jos dike and profile no. 9
  - Middle compartment, from profile no. 9 to profile no. 5
  - Downstream compartment from profile no.5 to barrage

Upstream and middle compartments has been divided in two sectors:

- West sector (upstream part of compartments)
- East sectors (downstream part of compartments)

Downstream compartments haven't been divided.

The Ialomita valley between the 66m and 69,2m in altitude represents the difference between the entire storage and the proper storage, with its banks up to 71m (field level). The couloir's morphology takes several forms: valley flume on which Ialomita river flows, valley terrace and Sitaru cut-off-lake. In ours analyses forms the interest us are the terraces and the cut-off -lake from Sitaru canal.

Three are the Ialomita terraces in this volume: river meadow terrace, middle and high terraces. The river meadow terrace is a perfect combination between the older river shaping and actual shaping, between what the river leave behind due to his deep and what storage leaves due to colmatage. This cooperation is visible 1-1,5 Km downstream of Fierbinti footbridge. This entire pound between one riverside and another represent the river meadow terrace as support for the first and oldest colmatage of Dridu storage.

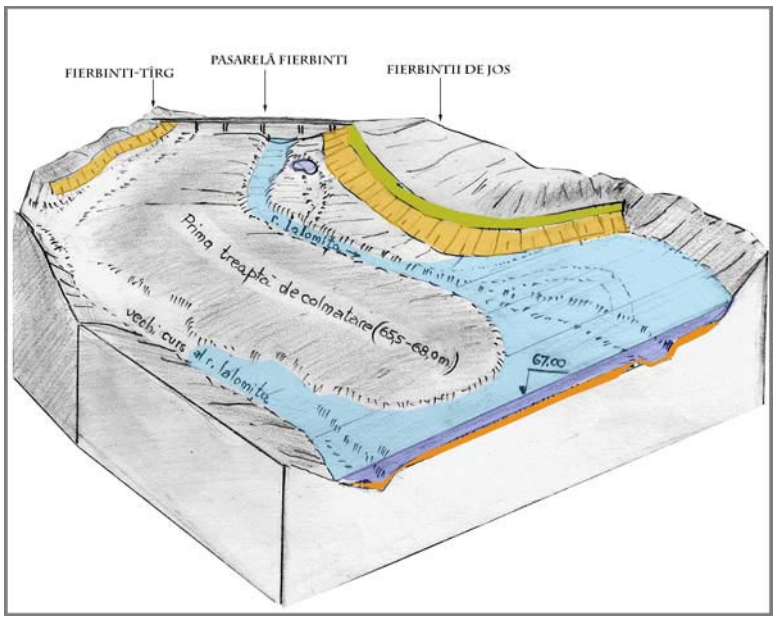


Fig. 2 West sector – upstream compartment

Between the two riversides, it covers the central zone. At the left bank, the Ialomita river has excavated the present river course and on the right riverside an old course is sustained by a damp zone. With this shape, slightly curved, placed on the axis between banks, the colmatage will advance downstream, to the next zone (3 Km till Fierbinti church and even far), affecting the storage.

Upstream the Fierbinti footbridge the river meadow terrace is attacked by river (erosion power increasing with altitude) being less developed. The same thing is happening with the middle terrace. On the contrary, the high terrace is well developed and continues the edge field to the riverbed.

In 1991, 1997, 1999 and 2001 when high waters occurred the middle terrace was partial covered by water. A thin layer of alluvium is visible upstream of Fierbinti Tirg and to Micsunesti. It is however covered by vegetation. Rare moments represented by extreme high water explain this superficial colmatage on the middle terrace.


Fig. 3 Upstream meander from Sitaru cut-of lake

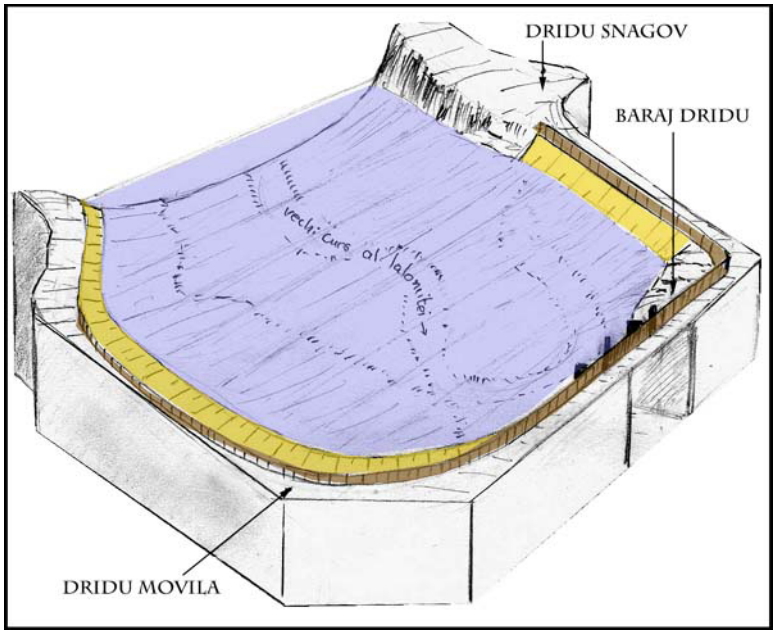
The colmatage degree had a significant growing between 1986 and 1999. If until 1996 the storage is clogged at 6,8% (with 1988 and 1991 high water contribution), the percent is doubling until 1999 reaching 15,8% because of high water from August 1997 and post high water colmatage process. Bathymetry from October 2001, after the June 2001 high water, illustrates a decrease of the colmatage percent from 15,9% to 13,4%. In longitudinal profile (2001 compared with 1999) a massive washing can be observed between no. 5 and no. 8 profile, in the middle section of storage, where declivity of longitudinal profile is

increasing. In the same time with washing process from the middle compartment of storage, aluvium deposit becomes visible between no. 8 and no. 10 profiles when the lake level is fewer than 66m.

Between colmatage and washing are some relations:

- There are colmatage areas but there are washing areas too
- They are synchronized but in some moments only one is prevailing
- The ratio between these two processes is depends on the storage level. At high levels, the colmatage assault the end of backwater and the area where the slope of longitudinal profile decreases to a gentile slope and to a profile rising. When the storage level decreases, while the level is retreating to downstream, the deposit is advancing. But where the slope of the longitudinal profile is increasing, the deposit is replaced by washing. This happens at larger discharge of toward to quick decrease of lake level and the discharge aspires a large part of alluviums. The washing process leads to a lower colmatage degree. On June 2001 high water, while the upstream compartment was clogged, the middle compartment was washed by alluvium because of large discharge of water (200 - 300 m/s). Washing process is also stimulating (between no 8 and no 5 profiles) the alluvium previous deposited. In the middle compartment longitudinal profile is becomes deep, increasing its slope.

Considering the 13,4% colmatage degree in 2001 we can say that at the Dridu storage the colmatage is in an incipient phase. It is the phase when the deposit is relatively



uniform, covering the upstream compartment especially, being visible at low water. In all other compartments (middle and downstream), in this incipient stage the colmatage looks like the applanation of an initial cavity.

Fig 4 Upstream compartment

The way the alluvium will be deposited depends on the lake level, the general lake configuration, streams, the discharge of water that generates washing in upstream and middle compartment. There are few particularities, closely connected by the alluvium way of deposit and also general elements, as following:

- The alluviums are deposited from upstream to downstream to advance, especially on the central zone of the storage. In the Dridu storage case there

are no tributary to the middle of lake or to the barrage witch to change upstream – downstream course of the alluvium advance.

- Because of the sinuous configuration of the storage, the colmatage process from end of backwater, placed on the lake axis, is deviated to right bank – in the middle compartment and replaced with washing process. In the upstream lake compartment, the streams deviate washing and erosion process to the left bank.
- Gulfs, cavities and promontories formed by Ialomita river before the building of the Dridu storage are rushing or slowing both colmatage and washing. Gulfs, due to their lateral position are less clogged because of their initial deep and because there are safe from direct colmatage strike, and the dry valleys formed by them are unimportant, without contribution to colmatage. Gradually, colmatage will attack central lake area (lakes axis), will look up gulfs, transforming them into small pools.

Cavities or natural hollow will also be slowly clogged because of their deepness. In the promontory case, the fight between processes is continuing. Stream directions will influent erosion and washing.

Fig. 5 9A gulf from Fierbinti church. January, 2002, level = 63,50 m

This is the Dridu Snagov promontory case, straight to no. 4 profile – eroded because of his position in front of upstream to downstream current - and continued on dam direction by weir.

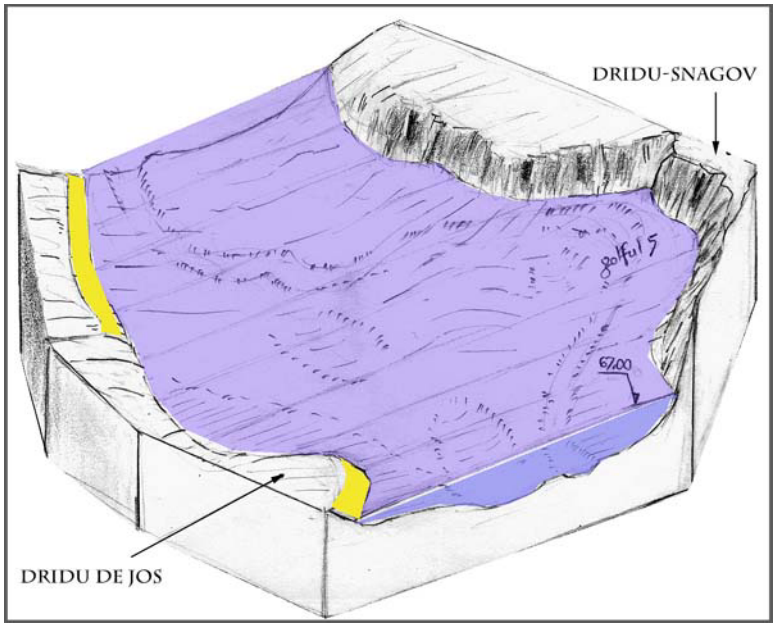
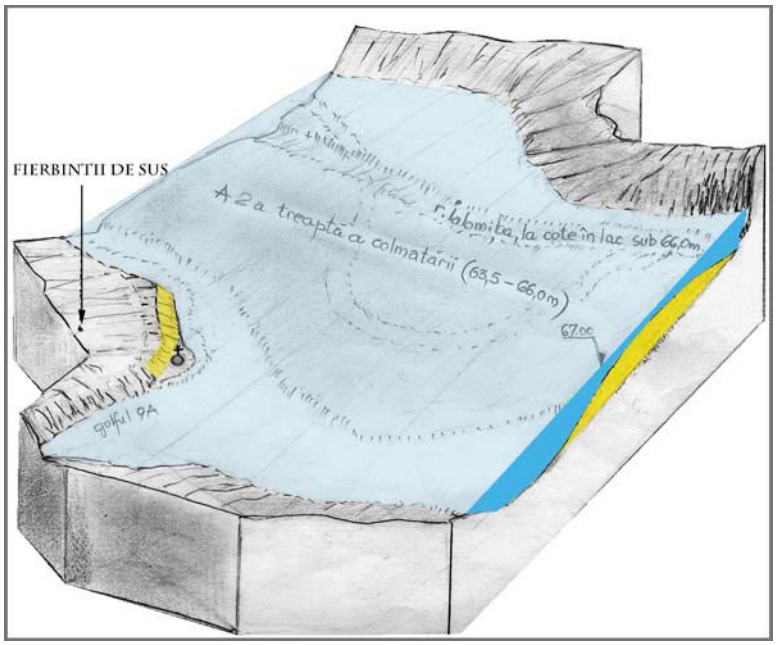


Fig 6 East sector – middle compartment

The promontory from the left bank (at the same 4 profile) it's like a screen in the stream way, protecting the colmatage to downstream. The promontory at the no. 10 profile (from the church) plays the same role that stops the colmatage to advance to the no 9A gulfs. On the left bank, opposing no 9A gulf, the colmatage is stopped by a promontory from no 9 and 19 profiles, being pushed to the center of the lake.

Let's analyze in particular the way the alluvium is deposit

- In the upstream compartment, colmatage represent the dominant form, both in west and east sectors. In both sectors colmatage is located in the central zone, being delimitated to the left bank by an old Ialomita watercourse and to the left



bank by present watercourse, visible at altitude under 66m. In the west sector first colmatage step become hard, dry and covered with grass (see fig. 2). Few swamps and damp zones remind of Ialomita migration from one bank to another while its colmatage is blocking its way.

Fig. 7 East sector – upstream compartment

In the east bank sector it appears as a new step (second colmatage step), lower then first. Though it becomes humid at levels higher then 66m, the silt is very consistent, almost hard, being an ideal support for advance and fix of reed (see fig.7). In the months when the lake level is under 66m (November – February) the colmatage becomes visible on large areas (see photo), between 9A gulf (at church) and the left bank, occupied by Ialomita watercourse.

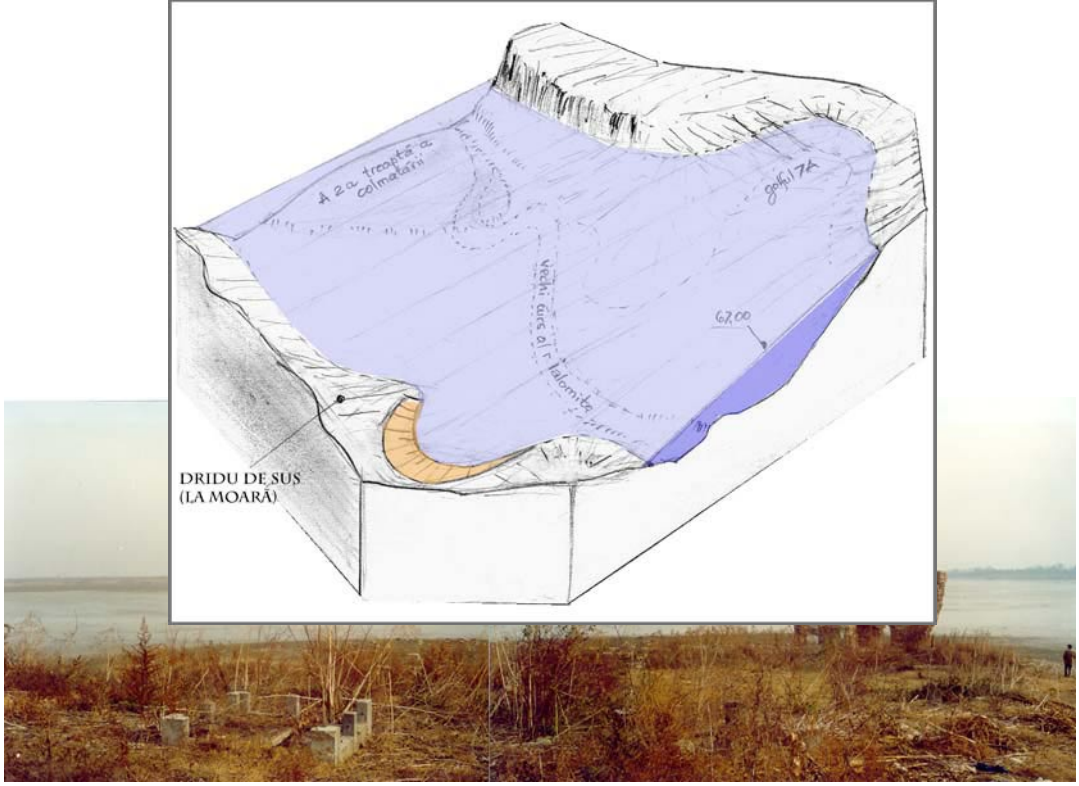


Fig. 8 First *colmatage step – downstream of Fierbinti footbridge*

- In the middle compartment the colmatage is gradually replaced by washing and erosion processes. Here the longitudinal profile is increasing its slope, following the initial profile because of washing that becomes the dominant process.

Fig. 9 The colmatage from Fierbinti church to left riverside. November 2002, level = 65,90 m

The erosion is attacking in particular abrupt banks, upstream and downstream of no. 7A gulf, causing landslide. In this compartment it is represented by a strip more and more thin (continuing the second step of colmatage from the upstream compartment) or by a dim form of an initial dislevelment. This is the compartment in where bottom and riversides morphology is in continuous transformation because of the battle between colmatage and washing. Only in 7A gulf transformation will be slower because of his lateral position.

Fig. 10 West sector – middle compartment

- In the downstream compartment, colmatage is not significant and appear (as in middle compartment) as a dim form of the cavities from the old site or as old Ialomita watercourse. On the right riverside, the colmatage has a large development because the no. 4 profile protects it from the streams. At left bank the colmatage is replaced by washing and erosion, the last one causing continuous landfalls.

Fig. 11 7A gulf and barrage January 2002, level=63,50m

Colmatage evolution in the next ears

Of course, this is an inevitable process. It will continue to advance to the middle compartment on the storage axis, especially moments of high water. At the same time, the colmatage will have moments of decrease because of discharge. Gulfs 9A and 7A will gradually transform in lakes isolated from the rest of storage.

An important role will be played by the vegetation, because of its advance that will help the colmatage to become rigid, without being dislocated by washing. Through its gradually raising the downstream compartment will become dry and will be covered by grass.

Conclusion

The Dridu storage can be considered a hydrotechnical organism, which life depends on this process called colmatage. Sudden (on high water) or slow (every day) colmatage process will transform the cuvette morphology and gradually but inevitable will lead to the Dridu storage ageing. Because of few numeric values concerning percent evolution of colmatage, is difficult to make an estimation of the ageing moment. Anyway, if a continuity in colmatage level is increasing, it is possible (in 2045 – 2050) that the Dridu storage not to exist as a hydrotechnical organism.

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