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Assessment of the reser voir sedimentation rates from ^{137}Cs measurements in the Moldavian Plateau

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ABSTRACT

Reservoir sedimentation has been recognized as an important environmental threat in the Moldavian Plateau of Eastern Romania. Measurements of the ^{137}Cs content of reservoir and, sometimes, floodplain sediments have been used to estimate the rate of sedimentation over the past 13-36 years.

The estimated mean sediment accumulation rates in the reservoirs from three geomorphological subunits vary between 2.6 and 7.9 cm/year with an average rate of 4.6 cm/year after April 1986. Strong relationships were established between the individual sedimentation rates and the drainage area within the southern and central part of the Moldavian Plateau.

The shape of the ^{137}Cs depth profile was used as the main approach. Taking into account that the standard pattern is in the form of a cantilever and based on burial magnitude of ^{137}Cs peak derived from Chernobyl two chief patterns of reservoir sedimentation were identified, shallow and deep buried cantilever, respectively.

Keywords: ^{137}Cs. Soil erosion. Sedimentation rates.

INTRODUCTION

The hydrological regime of the rivers in Eastern Romania is characterized by big fluctuations including either lack of streamflow or severe floods. The higher amounts of precipitation between 1966 and 1973 induced a marked period of dam planning and construction for multiple purpose use. In the course of time several reservoirs have been impacted by greatly increased sedimentation and loss of capacity in water storage. However, in many cases, it is necessary to mention that because of fishing practice temporarily, after an interval of two-three years the water level used to be brought almost down.

During the past decade a shift in emphasis has taken place regarding the need for more complete and accurate information on reservoir sedimentation. Classical sedimentation surveys involve repeated field measurements and, therefore, this is probably the most costly and time consuming method. The application of radionuclides, particularly ^{137}Cs, for water erosion and sedimentation studies in Romania has not been attempted so far. Research undertaken on some representative water reser-

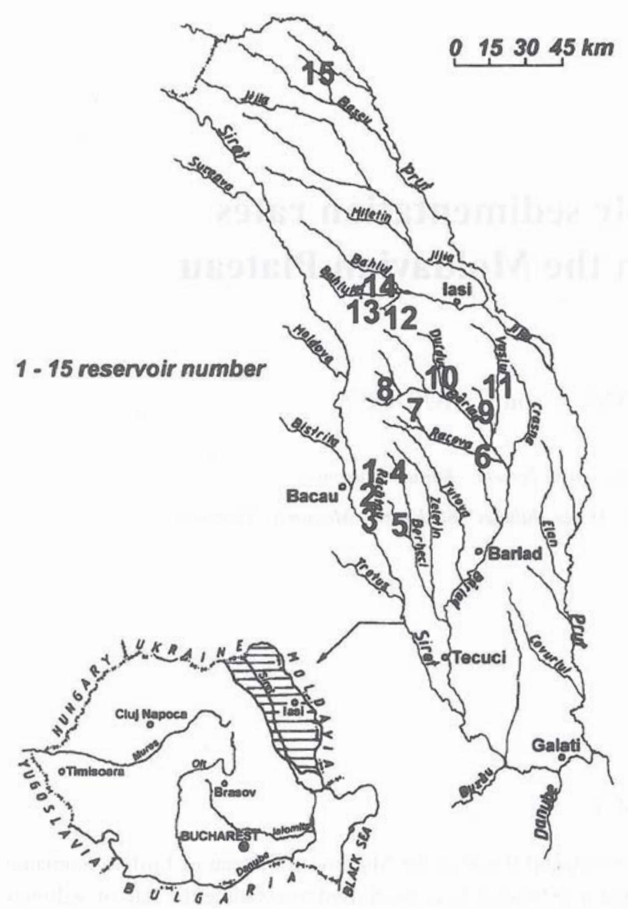

Figure 1. Moldavian Plateau study area showing the location of the reservoir.

voirs in the Moldavian Plateau was seen as an opportunity to test the potential of ^{137}Cs technique. The use of the fallout radionuclide ^{137}Cs offers considerable possibility of collecting adequate data on reservoir sedimentation and investigating the spatial variability of deposition rates and the patterns involved (Ritchie and McHenry, 1990, Walling and He, 1993, Walling and Quine, 1993, Walling and He, 1997). By dating the sediments within reservoirs it was possible to insight into erosion and sedimentation processes that are impossible to gain with other methods. This paper presents the results obtained on reservoir sedimentation rates in an area subjected to wide range in land degradation by sheet-rill erosion, gullies and landslides.

THE STUDY AREA

The Moldavian Plateau, located in the Eastern Romania and extending about 25,000 square kilometers is considered as the broadest and most typical plateau of Romania (Bacauanu et al., 1980). Clayey-sandy Miocene-Pliocene deposits with a gentle gradient of 7-8 m/km NW-SE has outcropped from sedimentary substratum as a result of erosion. Shallow intercalations of sarmatian sandstone and limestone can sometimes be identified (Jeanrenaud, 1971). As moving from the North to the South a regular, systematic decrease in clay content with increasing in sand percentage can be regarded. This plateau is situated between 32 and 564 m above sea level. The climate is temperate continental with a mean annual temperature of 8-9.8 ºC and precipitation of 460-600 mm. Although the natural vegetation cover was drastically changed by man two natural zones have been distinguished: the forested area that occupies the higher parts of the plateau and the area under silvosteppe (forest-grassland transition) and steppe (short grasslands). Slopes within the plateau are mantled by mollisols and forest soils.

The study area has been focussed mostly on three major units of the Moldavian Plateau:

- The Moldavian Plain, drained mainly by Jijia river occupies the northern part of the plateau, which is rich in clayey Miocene layers. Its average altitude is about 150m.
- The Central Moldavian Plateau that is well known by some structural plateaus bounded by north-looking cuestas. This region encompasses the upper Barlad basin, upstream from its junction with the Racova and Crasna rivers.
- The Tutova Rolling Hills, which are lying in the southern, sandy Pliocene area, being surrounded by the Racova, Barlad and Siret rivers.

METHODS

Between autumn 1996 and summer 1999 a number of 15 reservoirs have been gradually selected to estimate the depth of reservoir sedimentation. Figure 1 illustrates both the location of the Moldavian Plateau within Romania and the spatial distribution of reservoirs between the Siret and Prut rivers.

By means of an Eijkelkamp hand auger equipment a lot of holes were firstly drilled in each site to determine the original reservoir floor. Augering was performed both in the present lake area and in the upstream reservoir area already filed with sediments. In the first case, during warm season, drilling was done either from the watertable by means of a small platform or after periodical emptying the lake for fishing. Sometimes, during winter holes were drilled from the ice shell. At least one pit was dug in each reservoir. This representative pit was located as much as possible nearby the present-day lake inlet. Almost 360 sediment samples were collected usually at 50 mm intervals or according to the visible stratigraphy. Samples of reservoir deposits were dried, crushed and sieved. The combined method of sieving and pipetting was used to determine the particle size dis-

Table 1. Data on some reservoirs from the Moldavian Plateau, Romania.

No	Reservoir	Operation begining	Basin	Geographical position				Drainage area		
				Latitude		Longitude		Total	Forest land	
				Deg	Min	Deg	Min	ha	ha	%
				Tutova Rolling Hills						
1	Bibiresti	1975	Upper Racatau	46	31	27	05	3,912	840	21
2	Horgesti	1983	Middle Racatau	46	27	27	05	10,227	1,692	17
3	Racataul de Jos	1985	Lower46 Racatau	22	27	03	17,553	3,300	19	
4	Antohesti	1984	Upper Berheci	46	34	27	14	3,963	412	10
5	Hutu-Gaiceana	1983	Middle46 Berheci	21	27	15	4,665	2,166	46	
6	Puscasi	1973	Lower Racova	46	38	27	38	30,845	5,300	17
				Central Moldavian Tableland						
7	Pungesti-Garceni	1976	Garceana Racova	46	43	27	21	3,328	942	28
8	Ras-Craesti	1988	Upper Barlad	46	51	27	10	2,825	1,268	45
9	Moara Domneasca	1964	Feresti-Vaslui	46	44	27	45	6,593	418	6
10	Cazanesti	1975	Durduc-46 Barlad	52	27	29	19,097	7,637	40	
11	Solesti	1974	Middle Vaslui	46	47	27	48	42,352	12,445	29
				Moldavian Plain						
12	Doroscani	1963	Popesti-Scobalteni	47	11	27	16	329	-	-
13	Doroscani	1963	Doroscani Scobalteni	47	11	27	16	857	-	-
14	Podu Iloaiei	1966	Bahluiet-Bahlui	47	12	27	15	50,978	5,367	11
15	Ichimeni	1961	Bodeasa-Baseu	48	03	26	52	3,649	-	-

tribution. Data available at the time of writing include partial analyses for the organic matter content, 105 samples respectively.

Gamma spectrometry was used to determine ^{137}Cs concentration in sediment. The laboratory measurements were made using a Canberra MCA S100 system equipped with a Ge(Li) detector. The field samples were conditioned and measured. The acquisition time ranged from 5000 s to 60000 s per sample. The ^{137}Cs background on study area was determined by collecting spectra up to 200000 s and it is about 0.0015 cps. Efficiency calibration of the measurement system was performed using the IAEA-375 soil samples as reference material and some reference standards released by the Department of Radioisotope Production of IFIN-HH. The efficiency versus energy of the MCA system was determined using a standard set of radioactive sources. Soil samples were measured in 500 ml Marinelli beakers. The spectra were analyzed with SAMPO 90, a dedicated computer code for high-resolution spectrometry. The minimum detectable activity (MDA) for a collecting time of 40000 s is about 0.65 Bq/kg.

RESULTS

Estimation of the regional sedimentation rates

As indicated in Table 1 the catchments of the creeks are ranging from 329 to 50,978 hectares. Most of them are poorly covered by forest but in some cases the woodland is averaging up to 46 % of the drainage area.

Sediments in the reservoirs containing ^{137}Cs are usually more recent than late 1960s. The ^{137}Cs inputs derived from Chernobyl accident are prevailing towards those derived from testing of nuclear weapons. Among the results available at this time ^{137}Cs depth distribution is of a great interest.

By taking advantage of ^{137}Cs as a tracer it was possible to date a particular alluvial level and to calculate accurately the rate of deposition from the depth of material overlying this level. The results presented in Table 2 indicate that there is a clear regional differentiation in the magnitude of sedimentation rates. However, a mention must be made on the precipitation trend after 1982, which exhibits a marked drought pattern with smaller amounts of rain.

The mean sedimentation rate for the Moldavian Plateau after April 1986 is therefore 4.6 cm/year. The sites showing evidence of highest sediment accumulation rate are located in the southern part of the study area, averaging 7.9 cm/year. As regards the Central Moldavian Tableland the equivalent value was 3.6 cm/year, which is in a closer agreement with the general average. The highest sediment deposition rate from Tutova Rolling Hills reflects the increasing of mean soil erosion losses to 20-30 t/ha/year in this area as established by Motoc (1983). The sedimentation rate for the northern area, the Moldavian Plain, is 2.4 cm/year being by far the most reduced value. Here, this finding supports the long-term tradition in building small ponds, which represent a particular component of the local environment. Probably, the best interpretation of the regional differentiations in sedimentation rates would be that they are mostly consistent with the

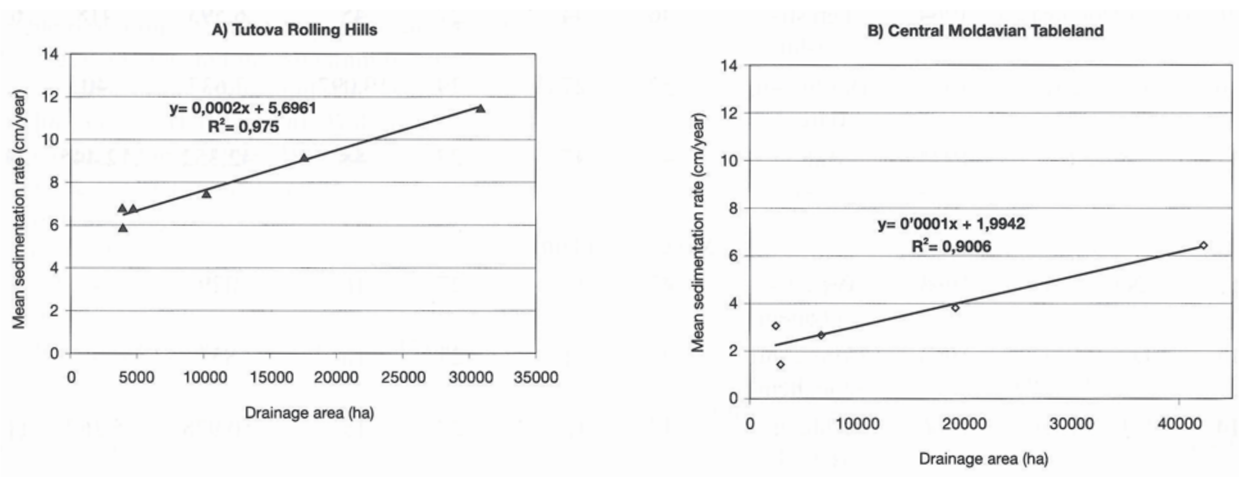

Figure 2. The relationship between the mean annual rate of sedimentation in some reservoirs and the drainage area from the Moldavian Plateau. a) Tutova Rolling Hills and b) Central Moldavian Tableland.

Table 2. Mean annual sedimentation rates past April 1986 for representative reservoirs on Moldavian Plateau using ^{137}Cs measurements.

No.	Reservoir	Mean sedimentation rate (cm/year)
Tutova Rolling Hills		**7.9**
1	Bibiresti	6.8
2	Horgesti	7.5
3	Racataul de Jos	9.2
4	Antohesti	5.9
5	Hutu - Gaiceana	6.8
6	Puscasi	11.5
Central Moldavian Tableland		**3.6**
7	Pungesti-Garceni	3.1
8	Ras - Craesti	2.0
9	Moara Domneasca	2.7
10	Cazanesti	3.85
11	Solesti	6.4
Moldavian Plain		**2.4**
12	Doroscani - Popesti	1.5
13	Doroscani	2.3
14	Podu Iloaiei	3.5
15	Ichimeni	2.3
Average		**4.6**

main changes in texture range of the underlying layers from clay in North to sand in South.

Strong relationships were defined by plotting the individual sedimentation rates to the corresponding area of the catchment for southern-central part of the study area, as shown in Figure 2 (A and B). In the Moldavian Plain the trend line is almost flat. The results of this broad-based study of sedimentation rates in reservoirs provide, therefore, the clue of a double value in the Tutova Rolling Hills towards the Central Moldavian Plateau and three times greater than the value within the Moldavian Plain. Furthermore, the decrease in sedimentation rate in the reservoirs from the southern to the northern part of the Moldavian Plateau involves a similar pattern on soil erosion rates.

Anyway, these results provided by using of ^{137}Cs measurements would represent the first successful attempt to estimate accurately quantitative rates of sedimentation in the Romanian reservoirs.

Patterns of reservoir sedimentation

Once having established the depth distribution of ^{137}Cs over different reservoirs in the Moldavian Plateau, much work have been conducted for interpretation of the ^{137}Cs profile and to identify the main sedimentation patterns.

The profile characteristics support the assumption that in most undisturbed sites there is a sharp decline in ^{137}Cs activity with increasing depth. Such an asymmetrical distribution of the ^{137}Cs would suggest a standard pattern in the form of a cantilever. If the validity of this assumption is accepted it is possible to define two major types of ^{137}Cs cantilever distribution: shallow and deep buried cantilever. The main criterion in classifying these patterns lies generally in the shape of ^{137}Cs depth profile and particularly in burial magnitude of ^{137}Cs peak derived from Chernobyl.

Shallow buried cantilever

This pattern typifies those areas where the ^{137}Cs - peak concentration exhibits in the upper part of the profile in general between 15 and 50 cm depth. This is especially true in the northern and central part of the Moldavian Plateau where rill-interrill erosion is the main sediment source. Thus, in the Moldavian Plain this is commonly occurring in the top 15-30 cm, indicating that the erosion and sedimentation rates are minimal.

A typical ^{137}Cs depth profile is depicted in Figure 3. The ^{137}Cs concentration in sediments from the upper part is high and uniform. Then, it shows a sharp decrease at a depth of 20 cm and underneath remains essentially low. Moreover, the particle size composition of deposited sediment in this site provides evidence of a sandy texture since the finer part of silt plus clay is averaging near 30 to 40% and the clay fraction does not exceed 10% of the total. Interestingly, this sediment feature produces a short range in particle size distribution and remains essentially constant over the entire study area. Thereby a strong relation between the depth distribution of ^{137}Cs and the proportion of fine particles has not always been noticed. This assumption supports the suggestion cited from other studies by Walling and Quine (1993) that the magnitude of the clay fraction does not limit radiocaesium adsorption. The depth profile of humus at Doroscani reservoir shows that the accumulated sediments have a high but rather uniform matter content varying between 3.1 and 4.8% in the first 65 cm.

Figure 4 is associated with the closest study site by Chernobyl which lies 420 km NE of Ichimeni reservoir.

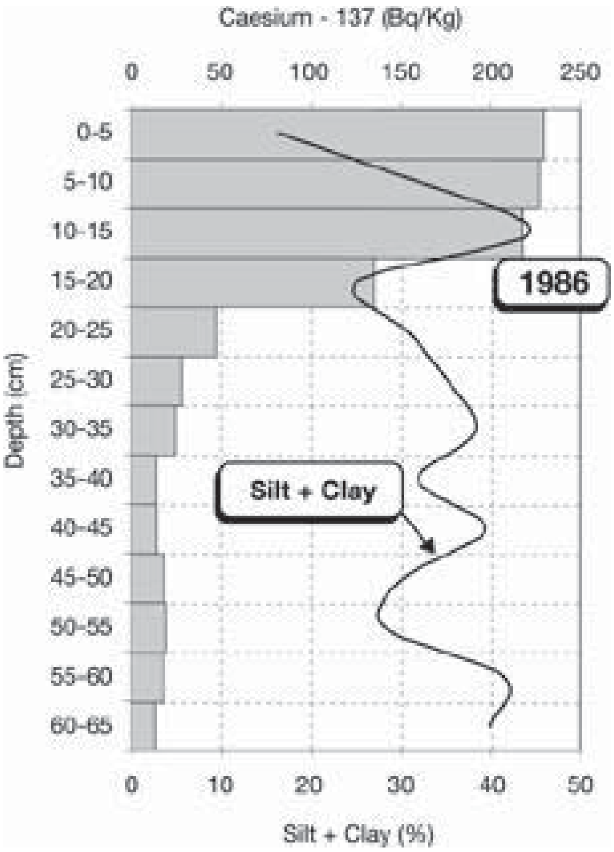

Figure 3. Distribution of ^{137}Cs and the silt+clay content in the Doroscani reservoir from Popesti-Scobalteni Basin, Moldavian Plain, Romania (October, 7th, 1998).

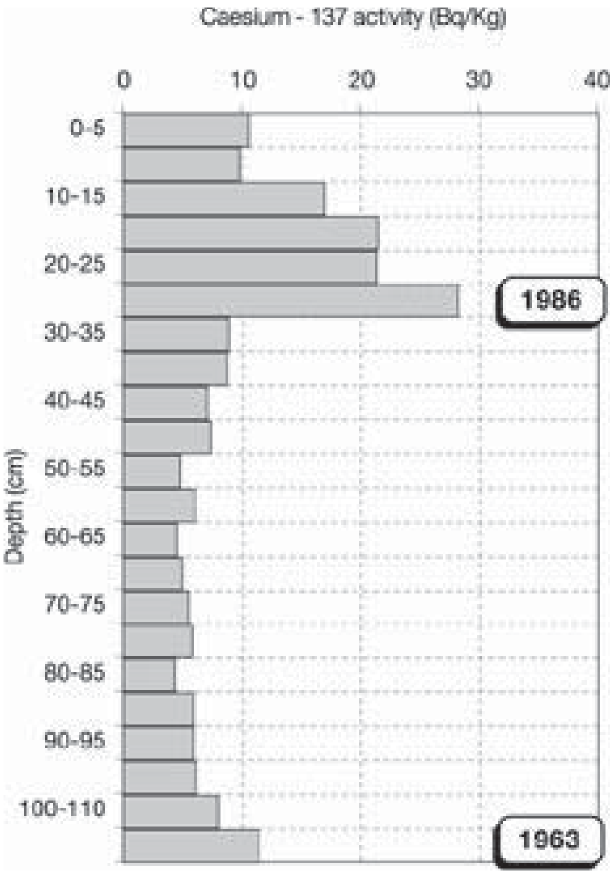

Figure 4. Distribution of ^{137}Cs in the Ichimeni reservoir, Bodeasa basin, Romania (April 14th, 1999).

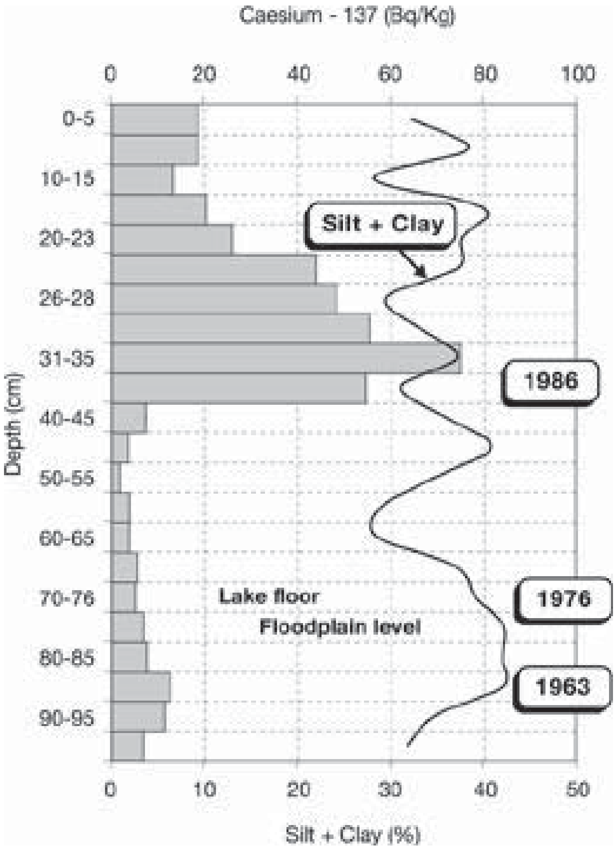

Figure 5. Distribution of ^{137}Cs and the silt+clay content in the Pungesti reservoir, Garceana basin, Romania (October 16th, 1998).

However, the ^{137}Cs concentration of the sediment at the main peak (25-30 cm) is 29.8 Bq/kg which is eight times smaller than the previous location from west of Jassy. Above this peak there is a gradual decline in ^{137}Cs activity indicating the depletion of ^{137}Cs inputs. Even both sites are characterized by resistant soils and geological layers to water erosion, the difference in the magnitude of ^{137}Cs peaks derives from local variation of precipitation. For example, at Popesti-Scobalteni were recorded small rains of 6.5 mm on the 28th of April, 1.5 mm on the 30th of April and 0.1 mm on the 1st of May 1986, while in its northern neighborhood at Podu Iloaiei reservoir during April was no any rainy event. In the latter reservoir this assumption is also emphasized by the low ^{137}Cs activity because its peak does not exceed 42.5 Bq/kg.

In addition, a minor but significant peak occurs at a depth of 110-120 cm, which was assumed to correspond to sediment deposited in 1963. That means the annual siltation rate over the period 1963-1998 was 3.5 cm/year. By relating the specific sedimentation rates for two periods, 1963-1985 (3.9 cm/year) and 1986-1998 (2.3 cm/year) is resulting a ratio of 1.7. This higher value of sediment accumulation during the former period can be attributed to the above-average precipitation over late 1960s and early 1970s.

In the reservoirs of the Central Moldavian Plateau the peak of ^{137}Cs concentration usually occurs in the alluvium layers at a depth of 30-50 cm. The distribution of ^{137}Cs by depth for Pungesti-Garceni reservoir from a small basin laying on the southern fringe of that geomorphological subunit is shown on Figure 5. The pattern in general, would be similar of that at Ichimeni in the North-eastern Romania. Because Pungesti reservoir has a shorter operation period of time there are exceptions. Apart from its deeper and higher ^{137}Cs peak there was no sig-

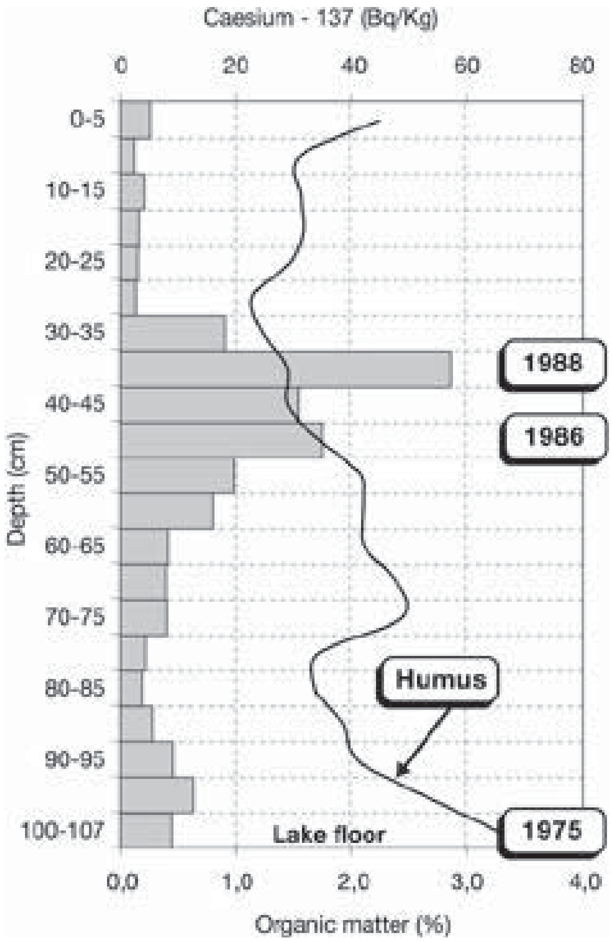

Figure 6. Depth distribution of ^{137}Cs and organic matter content in the Cazanesti reservoir, Durduc basin, Romania (May 5th, 1999).

nificant difference in the magnitude of sediment accumulation before and after 1986. These results from the ratio of 1.2 obtained by relating the mean annual rates of sedimentation tied to the periods 1976-1985 and 1986-1998. Furthermore, at depth of 85-90 cm the floodplain layer reveals a minor ^{137}Cs peak (13.0 Bq/kg) coinciding with the peak in bomb test activity during early 1960s. Based on these data it was possible to estimate the value of 1.1 cm/year as the normal mean aggrading rate on the floodplain over the period 1963-1975. For another small floodplain along the Ras Creek a similar value was estimated over the period 1963-1986.

Figure 6 depicts an entirely different situation associated to Cazanesti reservoir, which is by the same age as Pungesti. It lies in a larger basin Durduc-Upper Barlad of 19,097 hectares where forestland averages 40% of the total. This time there is a fairly significant difference in sediment deposition if comparing mean annual rates over the period 1975-1985 (5.2 cm/year) to 1986-1998 (3.85 cm/year). The ratio of 1.35 supports this assumption. The ^{137}Cs distribution in this profile shows the 1986 peak at a depth of 45-50 cm (34.7 Bq/kg). Taking into account the severe drought over the period 1986-1987 without significant streamflows it is obviously the strong impact of woodland area upon this distribution resulting in both a two years delay of the main ^{137}Cs peak (57.0 Bq/kg at 35-40 cm due to extremely rainy spring 1988) and a very low ^{137}Cs concentration above that peak in the top 30 cm. Also, there is no concordance between the ^{137}Cs and humus depth profiles but in this case the above 1% values of the organic matter content supports the assumption that rill-interrill erosion was the main sediment source. That means the forest succeeded in controlling soil erosion losses under an acceptable level.

To these situations may also be added a short note on two sediment profiles from the Moara Domneasca reservoir which was built in 1964. One of them dug upstream in the lake area filled with sediment indicates the main ^{137}Cs peak of 50.5 Bq/kg at a depth of 44-50 cm. Above it, between 44-25 cm the ^{137}Cs concentration decreases to 7.7 Bq/kg. Than, an increase in ^{137}Cs activity up to 29.3 Bq/kg in the top 25 cm is noticeable. By averaging and relating the sedimentation rates in both pits over the periods 1964-1985 and 1986-1998 a similar ratio of 1.7 with that from Ichimeni was found. This finding is a clue indicating that sediment accumulation was almost double during the former period towards the latter at least in the Central and Northern part of the Moldavian Plateau.

Deep buried cantilever

This pattern is closely related to those areas where the peak concentration of Chernobyl derived ^{137}Cs is commonly occurring at a depth of 50-100 cm below the sediment surface. The southern part of the Moldavian Plateau, Tutova Rolling Hills, has been recognized as an area facing with severe erosion and sedimentation, which increased burial of the main ^{137}Cs peak.

Figure 7 illustrates some pattern features at the Antohesti reservoir, upper Berheci basin. The proper cantilever is consisting in a normal arm, hanging at a depth of 60 cm (154-192 Bq/kg) and a drastic drop (under 5 Bq/kg) in ^{137}Cs activity with increasing depth. The widely variation in ^{137}Cs concentration in the top 60 cm is a result of combined sediment sources, rill-in-

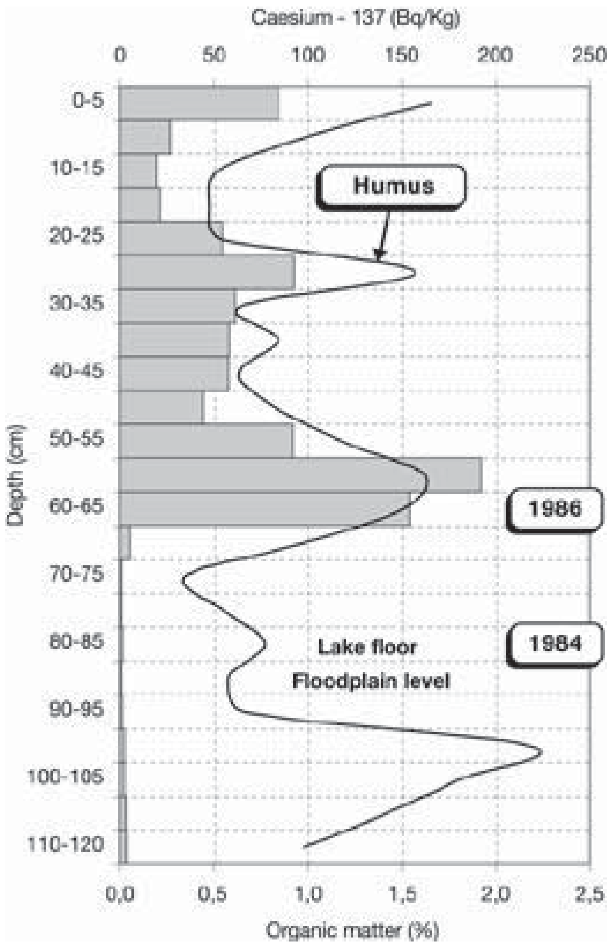

Figure 7. Distribution of ^{137}Cs and organic matter content in the Antohesti reservoir on Upper Berheci basin, Romania (May 14th, 1997).

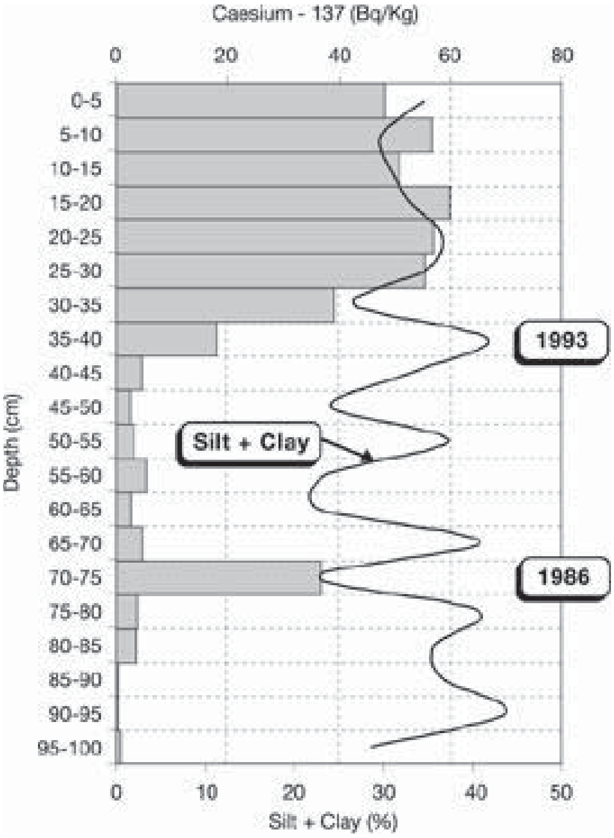

Figure 8. Distribution of ^{137}Cs and the silt+clay content in the Puscasi reservoir on Lower Racova basin, Romania (June 8th, 1998).

terrill erosion and gully erosion respectively. Anyway, the higher values are associated to the former erosion process an the lower values to gully erosion. This assumption may be justified by the strong relation between this minor ^{137}Cs peaks and distribution of organic matter content. In addition, in the floodplain layers between 87-120 cm there is no significant ^{137}Cs peak, which can be consistent with nuclear events from 1963. This partial distribution suggests the mean rate of aggradation on that floodplain for the period from 1963 to 1984 may be over 1.65 cm/year. The double value of sedimentation rate estimated in reservoirs from Tutova Rolling Hills towards those from Central Moldavian Plateau would indirectly support the assumption that the aggrading rate on small floodplains in this area was around 2.0 cm/year over the period 1963-1984.

Another sediment profile now dug in the lake area under similar sandy alluvial texture shows a higher ^{137}Cs peak (335.9 Bq/kg) at a depth of 55-60 cm and an increment of 0.5% in humus content corresponding to the same minor peaks.

Furthermore, the depth distribution of ^{137}Cs in the Hutu-Gaiceana reservoir reconfirms the buffer influence of woodland, which averages 46% of a catchment with high relief energy. Above the ^{137}Cs peak (70.4 Bq/kg at 70-75 cm) there is an evident alluvium thickness showing a very low ^{137}Cs activity. Just like in Cazanesti reservoir, Durduc basin, the prevailing forest hampered delivery of sediment with higher radiocaesium concentration. In turn, severe gully erosion and active landslides extended mostly over agricultural land, delivered a big amount of sediment, which is low in ^{137}Cs activity. In this case, the high sediment accumulation indicates that the influence of forest is rather a qualitative one since the woodland is more like a storage for radionuclides and the agricultural land delivers most of the sediment deposited within reservoir.

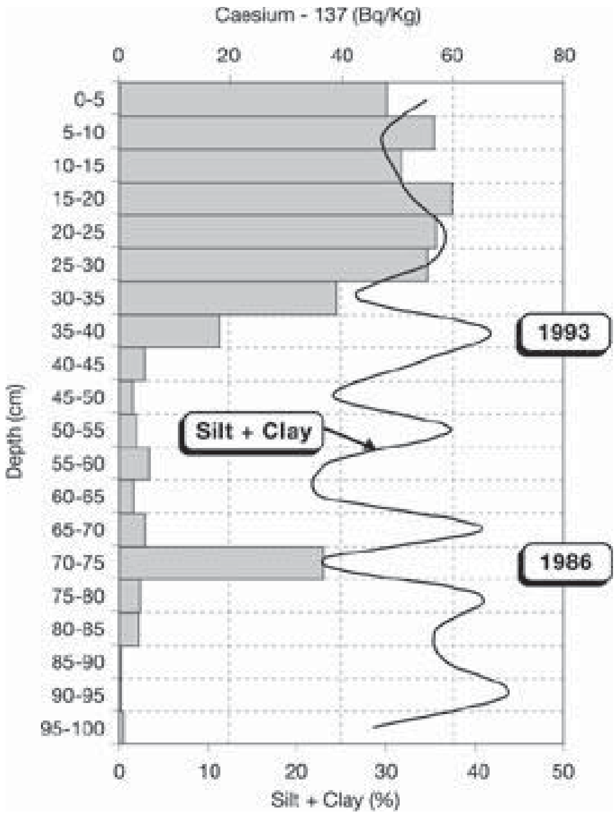

Figure 9. Depth distribution of ^{137}Cs and the silt+clay content in the Bibiresti reservoir, Upper Racatau basin, Romania (May 13th, 1997).

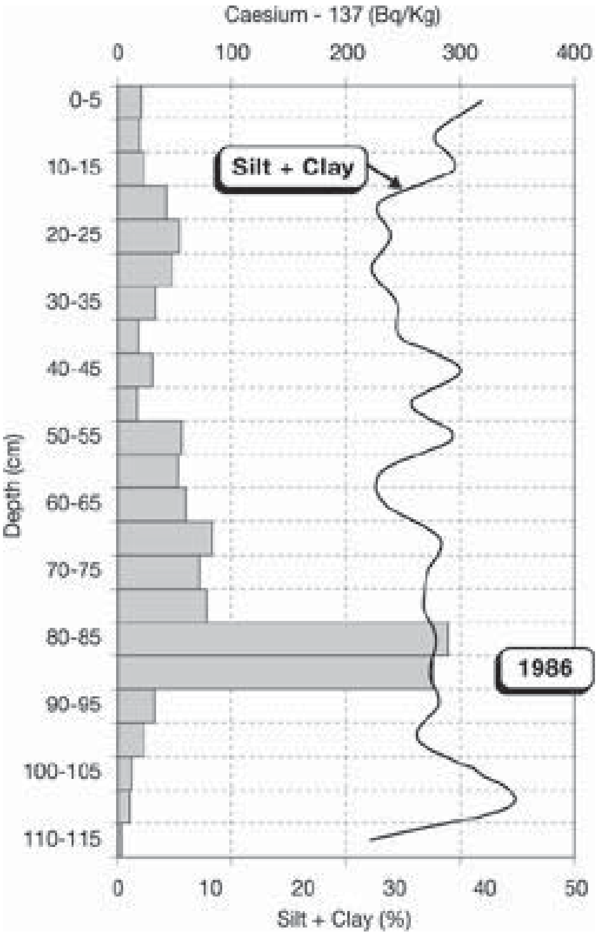

Figure 10. Depth distribution of ^{137}Cs and the silt+clay content in the Horgesti reservoir, Middle Racatau basin, Romania (June 11th, 1998).

The highest rate of sediment deposition over the entire study area, averaging 11.5 cm/year was identified on Puscasi reservoir, lower Racova basin, in Tutova Rolling Hills. Actually, Figure 8 depicts a very deep buried cantilever. As implies the name, the ^{137}Cs peak concentration (92.5 Bq/kg) occurs at a depth of 145-150 cm. Above the cantilever arm, between 145 and 95 cm there is a relative constant concentration in ^{137}Cs , around 43.0 Bq/kg. After a sharp decrease in ^{137}Cs activity from 95 to 55 cm, a slight flourishing in ^{137}Cs concentration is obviously in the top 55 cm even it is fluctuant. The wider range ^{137}Cs depth distribution provide evidence of combined sediment sources. The main inputs are connected to the right valleyside of the basin, developed mostly on sandy layers, which represents a broad steep cuesta.

There are exceptions from this pattern resulting from the impact of changes in land management. Such a marked situation was recorded at Bibiresti reservoir in the upper Racatau basin. During 1982-1985 appropriate conservation practices were implemented in this representative basin, mostly used as cropland. After implementing the provisions of the Landed Property Law no. 18/1991 this area was gradually converted in an up-and-down hill farming system and the rate of soil erosion and sedimentation doubled.

This finding is supported by the depth distribution of ^{137}Cs , which illustrates that under these circumstances the shape of the ^{137}Cs profile is in the form of a two storeys or double cantilever (Figure 9). The first storey clearly occurs below a depth of 70 cm (37.0 Bq/kg) being connected to April 1986, while the second is related to the revival in 1993 of the up-and-down hill farming. The mean siltation rates rose from 5.0 cm/year for the period 1986-1992 to 10.0 cm/year over the period 1993-1996. The ^{137}Cs activity during the former period of time was associated with low ^{137}Cs input (3-5 Bq/kg) indicating fairly soil erosion whereas the latter period is tied to severe rill-interrill erosion and the most significant ^{137}Cs inputs along this profile (up to 59.7 Bq/kg). Therefore, this particular ^{137}Cs depth distribution shows the 86% of the total inventory occurs in the top 40 cm deposited over the period 1993-1996.

In fact, all those examples showing such a ^{137}Cs revival in the upper part of the sediment profile provide evidence of the strong impact on the environment induced by the Law no.18/1991, which is not evenly distributed as dating.

Downstream in the middle Racatau basin, on a larger scale this particular pattern was changed as shown in Figure 10. The revival in ^{137}Cs activity in the top 45 cm is noticeable but subsequent in comparison with the major ^{137}Cs peak (ca. 280 Bq/kg) that occurs at a depth of 85 cm. The wide range in the magnitude of the main ^{137}Cs peaks in the Racatau basin is also resulting from spatial variability of precipitation.

CONCLUSIONS

Accumulation of ^{137}Cs on reservoirs in the Moldavian Plateau is mainly associated with the Chernobyl inputs and subsequently with ^{137}Cs derived from testing of nuclear weapons.

The estimated mean sedimentation rates in three geomorphological subunits vary between 2.6 and 7.9 cm/year with an average rate of 4.6 cm/year after April 1986. The lowest values are recorded within the reservoirs located in the northern area, the Moldavian Plain. The Central Moldavian Plateau is a transition zone while the Tutova Rolling Hills area has been impacted by greatest sedimentation. This regional differentiation is consistent with the decrease in clay and increase in sand content of substratum layers as moving from the North to the South.

Strong relationships were defined by plotting the individual sedimentation rates to the corresponding catchments within southern and central part of the Moldavian Plateau.

The asymmetrical depth distribution of ^{137}Cs activity in undisturbed sites suggests a standard pattern of reservoir sedimentation in the form of a cantilever. Taking into account the shape of ^{137}Cs depth profile generally and burial magnitude of Chernobyl-derived ^{137}Cs peak particularly, two main types of ^{137}Cs cantilever distribution were established: shallow and deep buried cantilever.

The pattern of shallow buried cantilever typifies those areas where ^{137}Cs peak concentration exhibits in the upper part of the profile commonly at a depth of 15-50 cm. This is especially true in the northern and central part of the Moldavian Plateau where rill-interrill erosion is the main sediment source. The deep buried cantilever is closely related to the Tutova Rolling Hills area, where the peak activity of Chernobyl-derived ^{137}Cs is usually occurring at a depth of 50-100 cm and sometimes deeper. There is a combination of sediment sources resulting mostly from surface erosion and gullying inputs.

If the sedimentation rates over two distinct periods 1963-1985 and 1986-1998 are compared a ratio of 1.7 can be estimated. This supports the assumption that during the former period with above-average precipitation sediment deposition in reservoirs was almost double.

A variable influence of the forest on ^{137}Cs and sediment inputs has been noticed. Main changes in land management, especially arising of the up-and-down hill farming after 1991 caused significant increase in erosion/sedimentation rate in comparison with the previous contour farming.

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