represent the ultimate receiving water. These sources of nutrient pollution are independent of each other and have seasonal effects.

This group includes the following parameters: nitrate ions or nitrate nitrogen ($N\text{-}NO_3$), nitride ions or nitride nitrogen ($N\text{-}NO_2$), ammonia ions or ammonia nitrogen ($N\text{-}NH_4$), phosphates (PO_4) and total iron (Fe).

The content of nitrates (NO_3) or nitrate nitrogen ($N\text{-}NO_3$) in the water of Krumovitsa River is low. The average values for both measurement periods are, on average, (NO_3) = 2.34 mg/l – 1.19 mg/l (Table 2). There is a downward trend during the second period, for both the average and the maximum results (Figure 5). The fluctuations follow closely the changes in river flow. The water in Krumovitsa river is category I for this parameter.

The nitrides (NO_2) or nitride nitrogen ($N\text{-}NO_2$) is an intermediary product of the nitrification process which is slow and dependent on many factors, including water temperature. The average values of nitrides change in the two periods as follows (NO_2) average = 0.08 – 0.05 mg/l. Maximum levels of 0.5 – 0.2 – 0.15 mg/l are measured at water quantities higher than 1.5 m^3/s, which shows prevalence of the slope runoff in this case. Zero values exist also during high and low water. No dependency of NO_2 and water flow exists. The water in Krumovitsa river is category II for this parameter.

The content of ammonia nitrogen ($N\text{-}NH_4$) or ammonia ions (NH_4) is low. The average values for (NH_4) for both periods are (NH_4)average = 0.04 mg/l. Increasing flows reduce the content of NH_4. The maximum levels measured during the second period are lower (Table 2). The water in Krumovitsa river is category I for this parameter.

The quantity of total phosphorus in the water of Krumovitsa River is low and changes within a narrow range. The average phosphate values for the two periods are (PO_4)average = 0.02 mg/l and (PO_4)average = 0.01 mg/l. The maximum measured value is (PO_4)max = 0.1 mg/l. No direct connection to the water flow is observed. The water in Krumovitsa river is category I for this parameter.

Krumovitsa River is poor in total iron (Fe). The average levels are too low, especially in the II period: (Fe)average = 0.04 mg/l (Table **3.3.2.2.**). The maximum levels have been measured in the periods of low-water. During high water, ($Q>1.5$ m^3/s), the quantity of total iron is below the observable minimum. The water is category I for this parameter.

Conclusion:

The content of nutrients in the water of Krumovitsa river is low, except for nitride ions (NO_2) making the water category II, and the category of the water for the other parameters, nitrates (NO_3), ammonia (NH_4), phosphates (PO_4) and iron (Fe), the category is I.

4. Toxic pollution

The information agbout the content of heavy metals in the water of Krumovitsa River in Krumovgrad is scarce. Maybe the reason is that such analyses are very expensive.

Depending on the properties and conditions of the aquatic environment, the heavy metals may be diluted or in a colloidal state and may adhere to the sediments in the form of particles of varying degrees of diseprsion.

Unlike other pollutants that are subject to destruction in time, heavy metals are present constantly in the aquatic ecosystems.

The studies during September 2004 show that only manganese (Mn) is above the lowest observable level. All other heavy metals occur in concentrations below the lowest observable level. The measured concentration of manganese is rather low Mn= 0.017 mg/l, and is of no interest.

Conclusion:

The water of Krumovitsa River is not polluted by heavy metals and are category I for this type of pollution.

5. Specific parameters of pollution

This group includes the following parameters: active reaction (pH), total hardness (H), phenols (Ph) and suspended solids. There is no relation between the indicated parameters and their priority consideration depends on the nature, type and source of pollution. However, these parameters affect to varying degrees, directly or indirectly, all other water parameters.

The active reaction (pH) of water in Krumovitsa River is neutral and exceptionally weak. The average values for the two periods are (pH)average = 7.47 and (pH)average = 7.35 (Table 2). The water is category I for this parameter.

The water of Krumovitsa River is not hard. As a general rule, the total hardness (H) of water is defined exceptionally by natural factors. The low hardness should not be a surprise in view of the manner of outflow formation, of the terrain, soil, and rocks. The average values change as H average = 8.29-6.84 H^{o}. Higher values are observed at low water. The water is category I for this parameter.

It can be assumed that studies so far have not indicated phenols (Ph).

One main parameters of physical properties of river water is the content of suspended solids that form the flow of solids in rivers. The concentration of suspended solids depends on the intensity of water erosion on the surface of the water basin, on the transferring capacity of the water flow, and on many other factors. The content of suspended solids of anthropogenic origin changes very much under the influence of water reservoirs, river bed corrections, etc. The precipitation and the surface type in the area under consideration allow good conditions for the formation of significant sediment flows. This is seen best during low-water periods when the water in

Krumovitsa River flows only underground. The sediment formations cause a sensation of a landscape from another planet. The reference is to the so-called drifting sediments occuring during high water periods and sweeping away everything in their path. It is not a chance that the maximum level, 262 mg/l, was measured in high water (Table 2).

In this case there is no anthropogenic impact over Krumovitsa River in Krumovgrad. The line is as follows: in low water – minimum content of suspended solids, and a maximum content in high water. In this case no category determination for this parameter is necessary.

Conclusion:

The active reaction of the water in Krumovitsa River is neutral and constant.

The water is not hard and can be used for cooling.

The water does not contain phenols.

The solids flow is formed entirely by natural causes.

Table 1

Parameters of Water Quality in Kesebir River

Date	Q,	T water	pH	O2	БПК5	Ok	HCO3	SO4	Cl	NO3
	m3/s	°C		mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
14.09.2004	0,029	14,0	7,20	11,40	2,31	2,60	89,40	30,10	11,40	0,61

Date	NO2	PO4	NH4	SUM	H	Phenols	Conductiv	As	Ca	Cd
	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mS/cm	mg/l	mg/l	mg/l
14.09.2004	0,001	0,01	0,00	144,00	4,1	0,00	132,10	<0.01	66,70	<0.004

Date	Co	Cr	Cu	Fe	K	Mg	Mn	Mo	Na	Ni
	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
14.09.2004	<0.004	<0.004	<0.004	0,09	2,10	17,90	0,010	<0.004	17,10	<0.004

Date	P	Pb	S	Sb	Se	Sn	Te	Zn	Al
	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
14.09.2004	0,09	<0.03	25,90	<0.02	<0.02	<0.02	<0.004	<0.004	<0.03

Table 2

Average, minimum and maximum values of the quality parameters for Krumovitsa River in Krumovgrad for the periods 1988-1994 and 1995-2004. Deviations of extreme values, in %

	pH	O2	BOD5	Ok	HCO3	SO4	Cl	NO3	NO2	PO4
	-	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
period 1988 - 1994										
average	**7,47**	**10,24**	**3,19**	**2,87**	**187,57**	**61,54**	**18,85**	**2,34**	**0,08**	**0,02**
max	8,20	12,70	9,80	5,40	259,20	120,78	25,74	6,91	0,55	0,10
min	6,64	6,40	0,80	0,80	115,90	11,10	14,10	0,51	0,00	0,00
D%max	9,72	24,07	207,00	88,33	38,19	96,28	36,58	195,71	560,66	330,77
D%min	11,11	37,48	74,94	72,10	38,21	81,96	25,18	78,17	100,00	100,00
period 1995 - 2004										
average	**7,35**	**10,33**	**2,85**	**2,77**	**165,59**	**54,90**	**16,69**	**1,19**	**0,05**	**0,01**
max	7,80	14,19	4,95	4,08	332,10	96,84	54,27	2,59	0,18	0,03
min	7,00	8,36	1,08	0,96	89,38	30,56	5,13	0,00	0,00	0,00
D%max	6,16	37,42	73,98	47,08	100,56	76,41	225,15	117,18	244,43	261,35

D%min	4,73	19,04	62,04	65,39	46,02	44,33	69,26	100,00	100,00	100,00

	Ca	Mg	NH4	Fe	Na+k	SUM	H	Phenols	Suspends	Conductiv
	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	oH	mg/l	mg/l	mS/cm
period 1995 - 2004										
average	**38,38**	**13,05**	**0,04**	**0,15**	**51,37**	**373,39**	**8,29**	**0,00**	**32**	**326**
max	63,47	31,10	0,33	0,85	128,20	520,77	12,34	0,03	262	476
min	15,20	4,00	0,00	0,00	5,00	197,82	2,58	0,00	2	236
D%max	65,35	138,27	747,71	473,37	149,54	39,47	48,82	1014,29	706	46
D%min	60,40	69,35	100,00	100,00	90,27	47,02	68,89	100,00	94	28
period 1995 - 2004										
average	**32,26**	**10,54**	**0,04**	**0,04**	**62,90**	**344,21**	**6,84**	**0,00**	**13**	**306**
max	65,97	34,56	0,17	0,32	173,07	556,03	12,90	0,02	67	587
min	13,25	2,88	0,00	0,00	0,06	157,09	1,86	0,00	2	163
D%max	104,47	227,96	336,22	735,39	175,13	61,54	88,48	406,39	404	92
D%min	58,94	72,67	100,00	100,00	99,90	54,36	72,85	100,00	81	47

Table 3.3.2.3.

Classification of water in Krumovitsa River in the town of Krumovgrad

Σi	O2	BOD5	Ok	N-NO3	N-NO2	PO4	Fe	pH	H	Mn
period 1988-1994										
I	I	II	I	I	II	I	I	I	I	I
period 1995-2004										
I	I	I	I	I	II	I	I	I	I	I

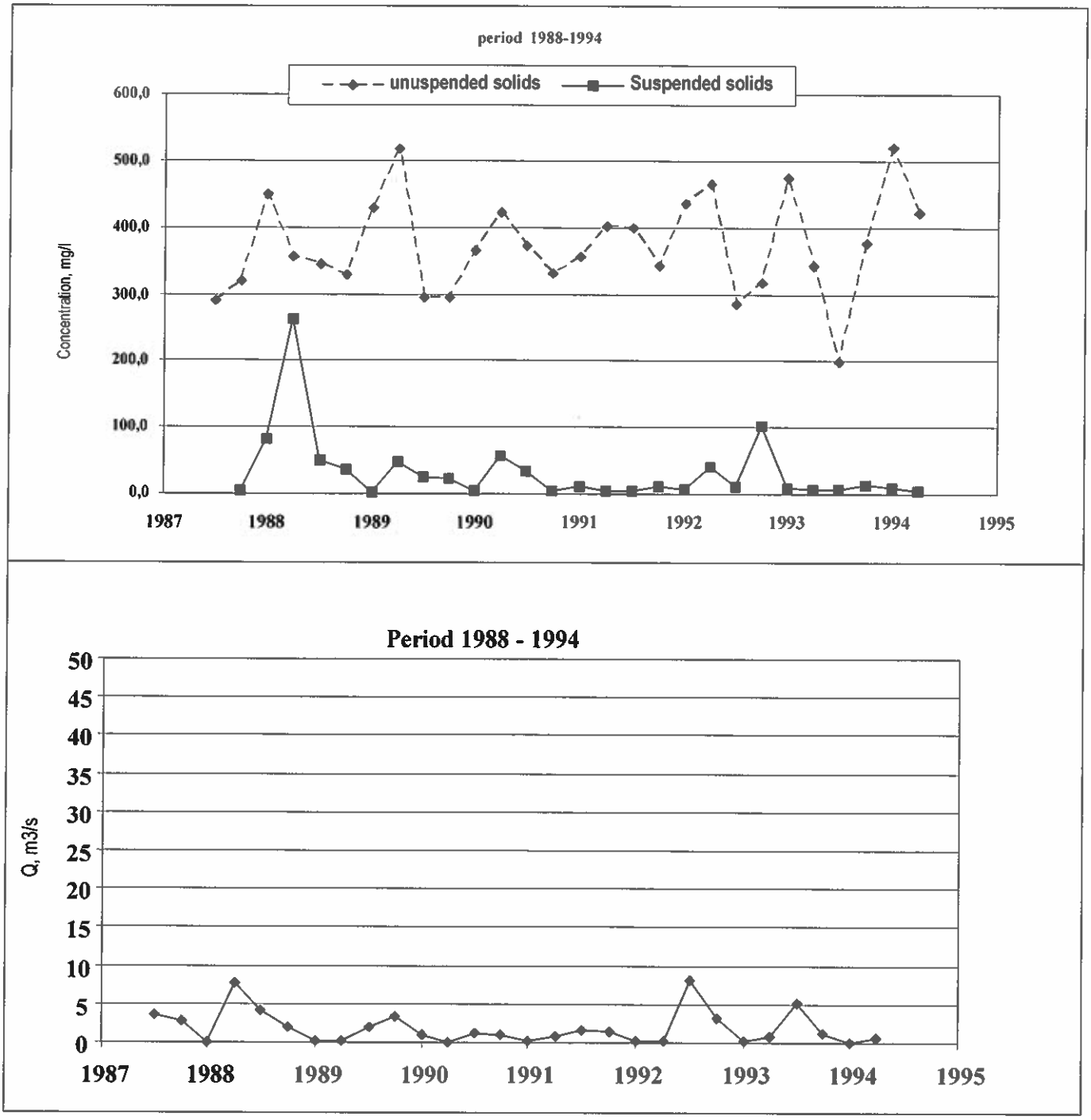
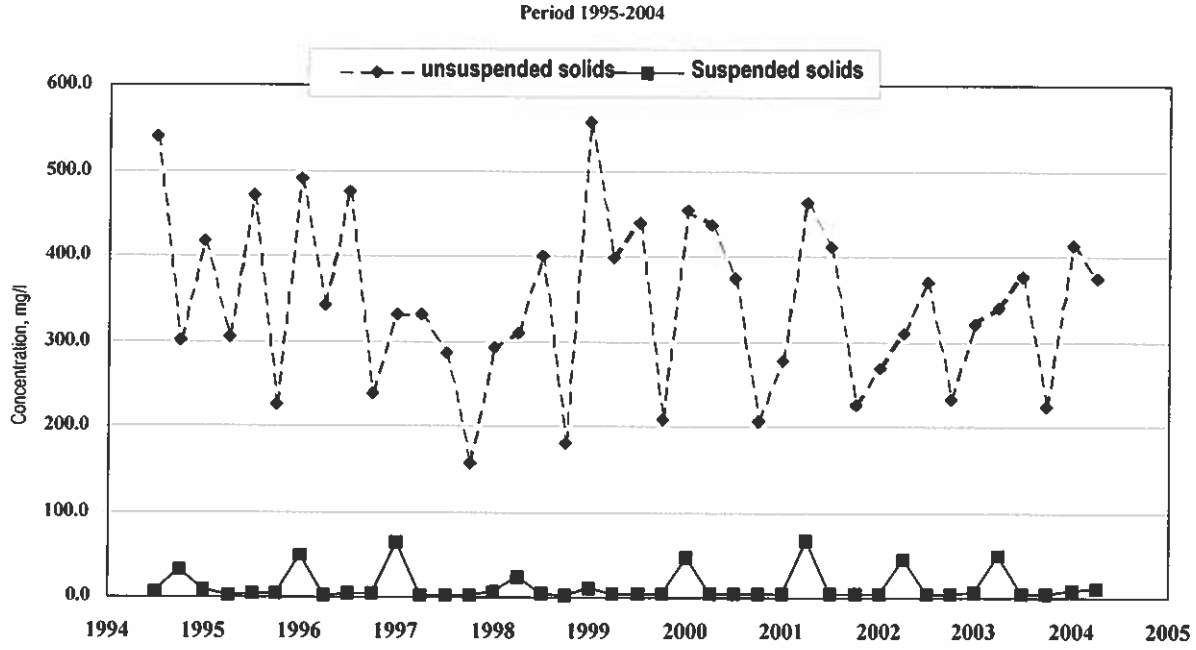


Figure 1. *Changes in water quantity and content of dissolved and suspended solids in the water of Krumovitsa River in Krumovgrad for the period 1988-94*



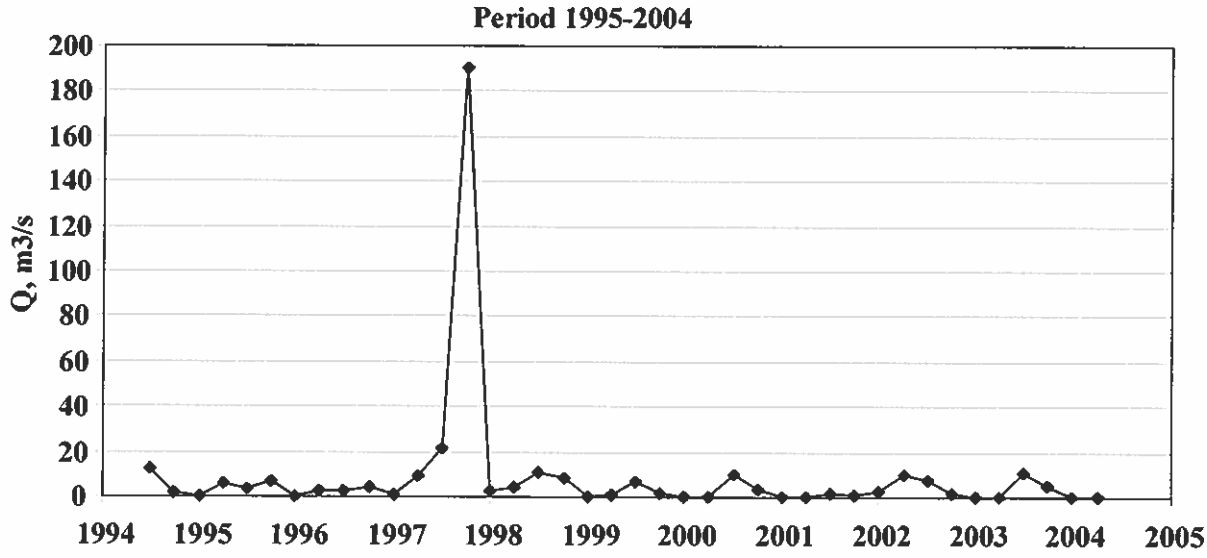


Figure 2. *Changes in water quantity and content of dissolved and suspended solids in the water of Krumovitsa River in Krumovgrad for the period 1995-2004*

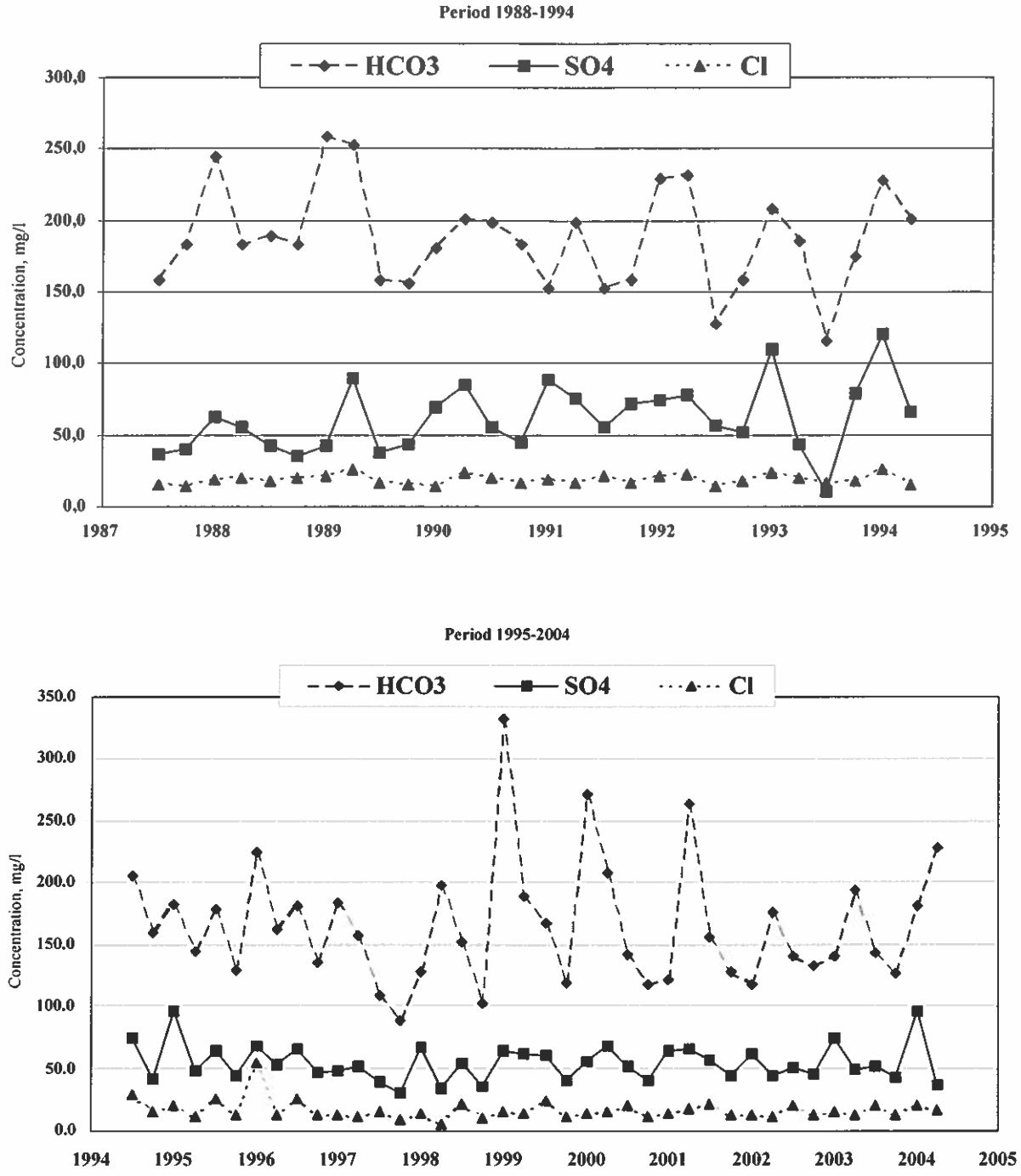


Figure 3. *Changes of the mineral composition of water in Krumovitsa River in Krumovgrad: hydrocarbons (HCO_3); sulphates (SO_4), chlorides (Cl), for the periods 1988-94 and 1995-2004.*

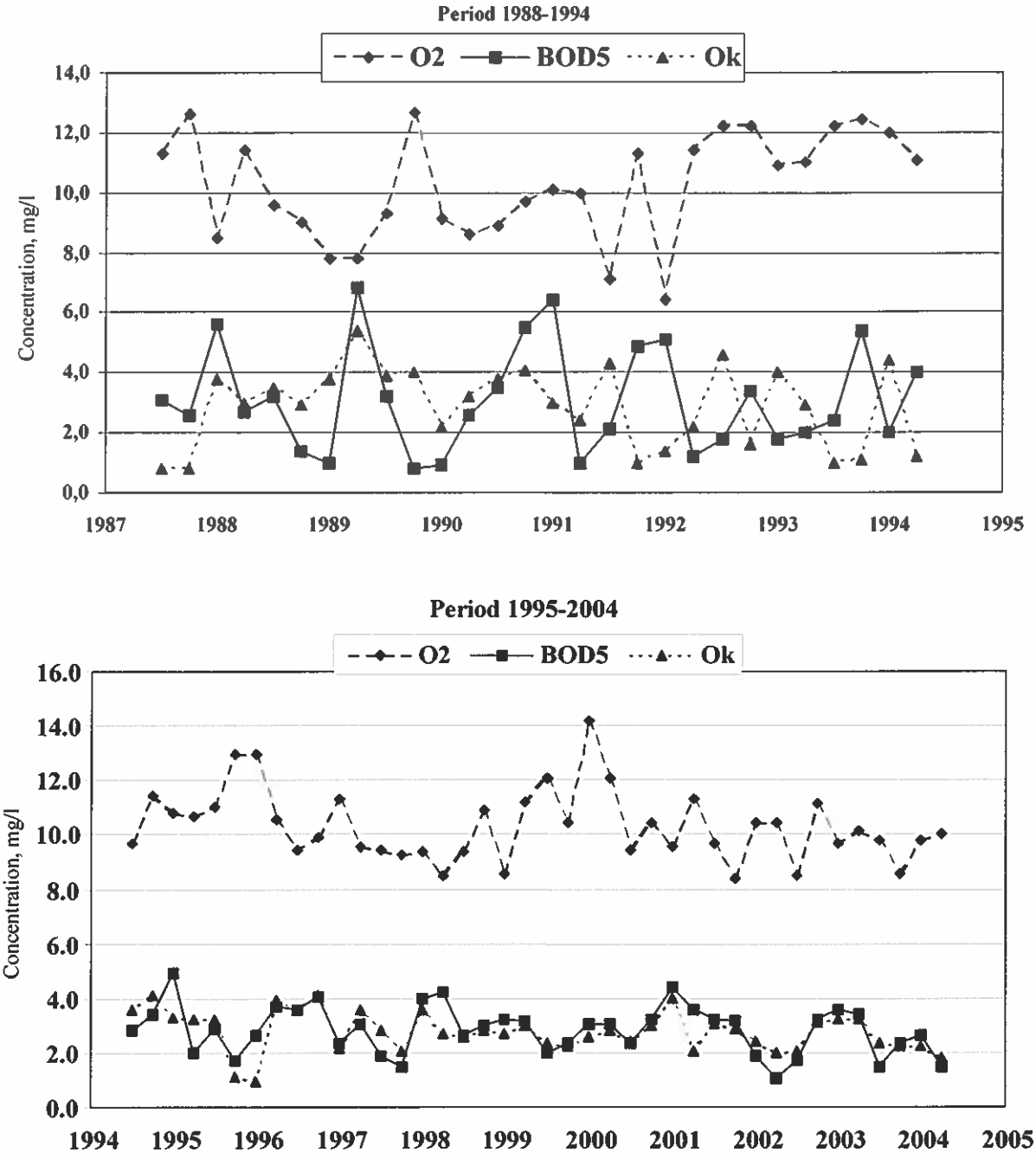


Figure 4. *Changes of oxygen and organic content in the water in Krumovitsa River in Krumovgrad: dissolved oxygen (O_2); BOD5, permanganate oxidation (Ok) for the periods 1988-94 and 1995-2004.*

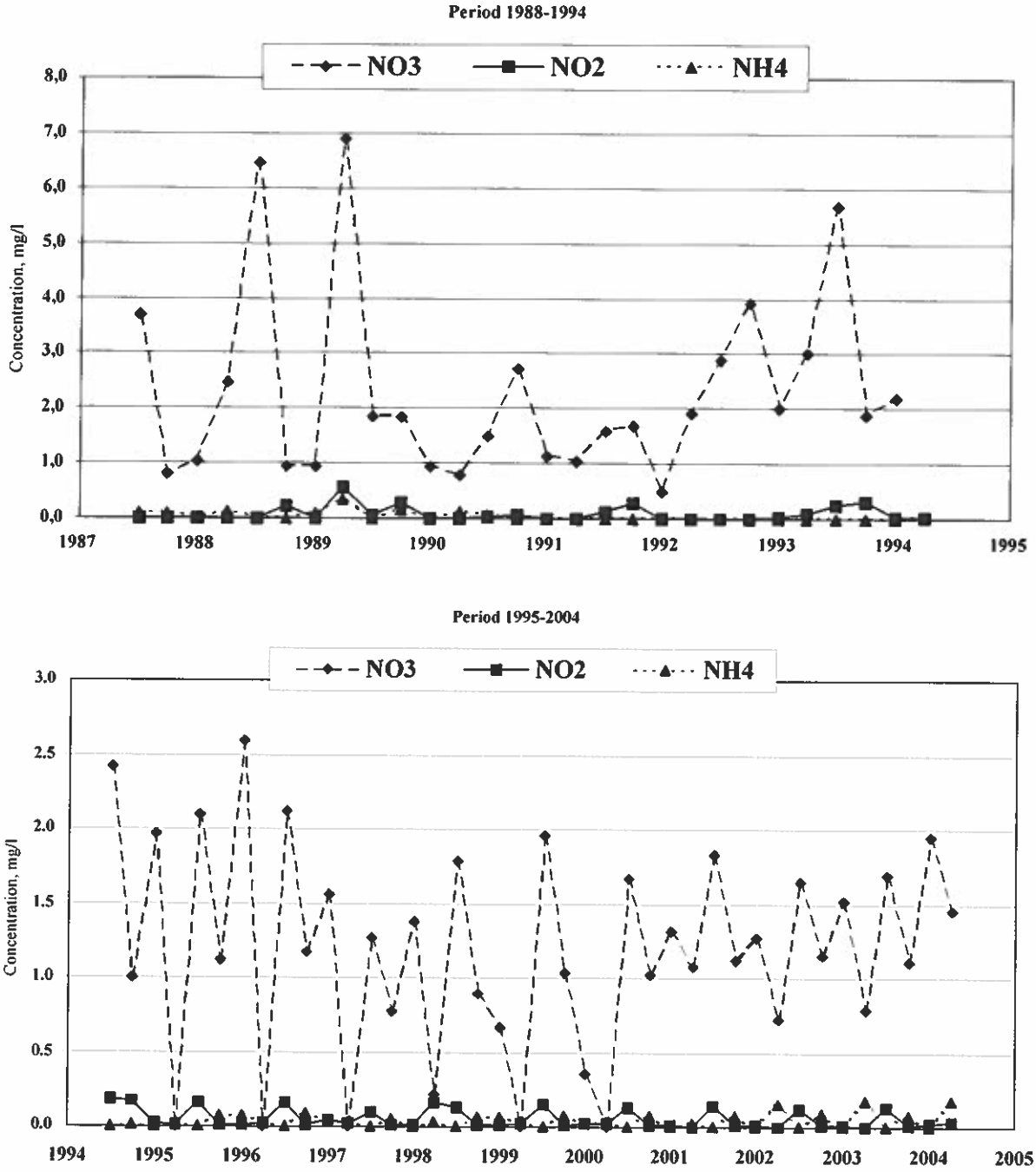


Figure 5. *Changes of nutrient content in the water in Krumovitsa River in Krumovgrad: nitrates (NO_3); nitrides (NO_2), ammonia ions (NH_4) for the periods 1988-94 and 1995-2004*