SHORT HISTORY OF THE HYDROGEOLOGICAL INVESTIGATIONS OF THE KARST IN ROMANIA

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Investigation of karst areas is a multi-disciplinary approach, which is the reason why in these areas the efforts of landforms investigators, cavers, geologists, hydrologists and hydrogeologists interpenetrate, one being unable to specify exactly where some of them start, and where others end. This is also the case of the research performed in karst areas of Romania, where the first information on karst springs and groundwater flow has been provided by geographers, geologists and cavers.

In the year 1863, the Austrian geographer A. SCHMIDL has published in Vienna the work "Das Bihar Gebirge and der Grenze von Ungarn und Siebenburgen", the first extensive geographical study addressing the karstology and the speleology of an area within the territory of our country. The author provides a detailed description of the karst in the mountains Bihor, Vlădeasa and Codru Moma, of the main karst springs, of the mineral and thermal springs in those mountain bodies and in Beiuş basin.

In the year 1901, the Romanian geologist S. MIHUŢIA has performed the first tracer testing of an underground stream course in Romania. By labeling the water of Ţarina stream with charcoal powder, he outlined the hydrologic connection between Câmpeneasca cave, in Vaşcău karst plateau, and the Boiu spring, next to Vaşcău town (S. MIHUŢIA, 1904).

In 1908, Marghitaş and Buhui dams are built on Buhui stream, the lakes being the only ones in Romania placed on limestones. Downstream Buhui lake, controlled water by the dam is then distributed in the limestones area and feeds, together with Certej spring, the underground flow of Buhui cave. At the end of the cave there is an artificial underground lake, its water supply Anina town through an artificial gallery, of 1.3 km long (V. SENCU, 1967).

EM. PROTOPOPESCU-PACHE, in his studies undertaken in Mangalia area, sets the water drainage to the springs of sulphurous bath in the South, as well as the springs placed to the East, towards the sea, to Constanta highway, by marking with uranite the waters overflown from Kara-Oban lake in the nearby ponor (R. COCÂRDEL, EM. PROTOPOPESCU-PACHE, 1955).

The first systematic hydrologic investigation of the landforms in the karst areas of Romania has been performed by the Institute of Speleology "Emil Racovita" (ISER) and by the Institute of Geography. Starting from the very first papers published by the scientists of those two institutes, M. ŞERBAN, D. COMAN and I. VIEHMAN (Bihor Mountains, 1957), T. RUSU, GH. RACOVIŢĂ and D. COMAN (Bihor Mountains, 1970), I. VIEHMAN (Bihor Mountains, 1958, 1966), V. SENCU, (Anina area, 1970, 1978, 1986), T. RUSU (Pădurea Craiului Mountains, 1960-1988), V. TRUFAŞ (Sebeş Mountains, 1965) and from ISPIF, BIŞIR and M. PASCU (Cerna area, 1967, 1969), there can be noticed their obvious concern for identifying the groundwater flow paths, fluorescein tracer tests being performed in this respect.

Over the time interval 1960-1988, the Pădurea Craiului Mountains karst areas have been subject to detailed karst topography and hydrology investigations conducted by T. RUSU, who performed a multitude of fluorescein tracer tests, by which he outlined the main karst flow directions. The integral publication of those results occurred in the year 1988.

The Institute of speleology "Emil Racoviţă", specifically its research worker I. POVARĂ, has carried out over the period 1965-2007 an extensive activity of investigating the karst hydrogeology of Cerna stream catchment area, of Mehedinţi

Mountains and Plateau, West Jiu area and South Dobrogea. T. CONSTANTINESCU performed tracer tests in Piatra Craiului Massif, G. DIACONU in Motru Sec area and I. POVARĂ and V. HOROI in Ardeu watershed. The chemistry of the karst waters in Pădurea Craiului, Cerna trough and Mangalia area made the object of very detailed studies signed by C. MARIN.

In 1974, M.BLEAHU publishes "Karstic morphology", an encyclopaedia about the karst and its genesis, a work of a highly positive impact on researching the karst in Romania.

Starting from the year 1970, the Hydrogeological survey department of Prospectiuni S.A. company has carried out a constant activity aimed at investigating the carbonate rocks areas, in order to complete hydrogeological maps, to compute the water budget, to assess the groundwater resources, to delineate the main karst flow paths and to outline the groundwater chemistry. Those investigation projects addressed most karst areas in Romania, being performed by: G. SIMION (Mehedinţi Mountains, Cerna-Jiul de Vest area), I. LAZU (Mehedinţi Mountains), M. FERU (Mangalia area), NICOLLE & I. ORĂŞEANU (Pădurea Craiului, Codru Moma, Bihor Vlădeasa, Trascău Mountains, Poieni plateau, Rapolt crystalline limestones outcrop, Dâmbovicioara Pasasage, Postăvarul Massif, Reşiţa-Oraviţa area, Teliuc-Ghelar zone, Mangalia area), E. ANGHEL (Moneasa and Teliuc-Ghelar areas), A. IURKIEWICZ (Pădurea Craiului and Vâlcan Mountains, Reşiţa-Moldova Nouă area), N. TERTELEAC (Codru Moma, Dâmbovicioara Passage), GH. PONTA (Codru Moma, Cernişoara-Jiul de Vest area), ELENA & R. STRUSIEVICI (Cernişoara-Jiul de Vest area), RUXANDRA & D. C. SLĂVOACĂ (Vâlcan and Bucegi Mountains, Mehedinţi Mountains and Plateau, Cernişoara-Jiul de Vest area), RĂDIŢA & G. BANDRABUR (Petreşti-Tureni area, Babadag Basin, Poiana Ruscă Massif, Mehedinţi Mountains and Plateau, Sebeş Mountains, Parâng and Căpăţânii Mountains, Cernişoara-Jiul de Vest area), MIRELA & C. PANAITESCU (Perşani Mountains), G. DRAGOMIR (Hăghimaş Mountains), G. DRAGOMIR and C. NAN (Reşiţa-Anina area), A. ROTARU (Anina-Nera area), A. ANGHELI (Nera-Dunăre area) and E. CĂPRARU (SW Vaşcău Plateau).

In order to delineate the groundwater flow paths, the company Prospecţiuni S.A. has performed about 170 tracer tests, many of them in cooperation with the Tracer group of Institute of Physics and Nuclear Energy (IFIN) led by E. GAŞPAR. For these tracer tests, there have been initially used radioactive tracers (Iodine-131, Bromide-82), and after the year 1980, activable tracers (In-EDTA, Dy-EDTA, La-EDTA), fluorescent tracers (fluorescein, rhodamine B) and whitening optic agents (stralex). To some of the tracer tests performed in Apuseni Mountains, there has also taken part a group from the High School Institute in Baia Mare, led by I. POP.

In 1970, D. I. SLĂVOACĂ, I. ORĂŞEANU, E. GAŞPAR and AL. BULGĂR (1985), confirm the continuity of limestone in the Danubian Unit under crystalline schists in Motru Sec- Baia de Aramă by labelling with Iodine-131, demonstrating thus, based on a hydrogeological method, the presence of the Gettic Nappe. A marking done 29 years later, in 1998, by G. & RĂDIŢA BANDRABUR, D. C. & RUXANDRA SLĂVOACĂ (1998-1999), in between the lost Prejna river at Balta and Bârza spring, supports the continuity to South-West of the same tectonic structure. Another labelling, contributing to confirming regional geological structures, was done in Bihor Mountains, the hydrological connection between the losses at Valea Seacă stream and the spring of Crişu Băiţa stream confirming the continuity of the Bihor Unit limestones under the permian sandstones of Arieşeni Nappe at Tapul peak (I. ORĂŞEANU, E. GAŞPAR, I. POP. T. TĂNASE, 1991).

The National Institute of Hydrology and Water Management (INHWM), specifically its research workers P. NIŢĂ, AL. BULGĂR, P. MIŢĂ, DIACONU V., OANCEA V. performed hydrologic investigations, together with tracer tests. The group in INHWM, including A. ŢENU, F. D. DAVIDESCU and ANA SLĂVESCU, has completed investigations addressing the karst water dynamics by means of environmental isotopes. Detailed studies addressed the investigation of the karst aquifers in South Dobrogea, Valachian Platform and the origin of the thermal water at Geoagiu and Felix-1 Mai Spa.

The tracer labellings performed by Institute of Study and Design for Land Reclamation (ISPIF), especially by M. Pascu, highlight the underground connexion between losses in Jiul de Vest watershed and Cerna spring and between losses in flow of Motru Sec river and springs in Baia de Aramă area. Were also established sanitary and hydrogeological protection areas of Runcu and Jaleş springs in Vâlcan Mountains (R. PASCU, DANA VELICIU, 2000).

The investigation of the karst aquifers in South Dobrogea focused the interest of a multitude of scientists, among which we mention: R. CIOCÂRDEL and EM. PROTOPOPESCU-PACHE (1955), C. DRAGOMIRESCU (1971), I. NAINER (1971-1973), N. PITU (1980), V. MOLDOVEANU (1987-1988), F. ZAMFIRESCU, A. DANCHIV, M. ALBU, M. ENĂCHESCU and V. MOLDOVEANU (1993), F. ZAMFIRESCU, V. MOLDOVEANU, C. DINU, N. PITU, M. ALBU, A. DANCHIV and H. NASH (1994).

Contributions to the investigation of Mangalia area are due to GH. VASILESCU and SILVIA MATEI (1967), A. ŢENU and G. NEACŞU (1968), I. NIŢĂ (1971), M. FLORIAN and GABRIELA POPESCU-DUMITRESCU (1972), I. IANCULESCU (1980), E. GAŞPAR and I. ORĂŞEANU (1987), I. ORĂŞEANU (1993, 1994), V. MOLDOVEANU, C. DINU, P. GEORGESCU and V. NICULESCU (1988-1990), M. FERU and ANA CAPOTĂ (1991), M. FERU (1993), I. POVARĂ (1994), C. MARIN and TUDORA NICOLESCU (1993), T. PARKER (1994).

Consistent data regarding geological structure and hydrogeology of karst reservoirs has brought by drilling wells performed by Foradex SA (former ISEM company), Enterprise for Driling and Special Geological Works (ISLGC) and Institute of Balneology and Physiotherapy (IBF)

Starting with 1970, the Institute of Atomic Physics, later named Institute of Physics and Nuclear Energy, has brought major contributions, by the team led by E. GAŞPAR, to developing and applying marking technologies with radioactive and activable tracers in the study of karstic aquifers. In a permanent cooperation with researchers from institutes involved in the study of karstic areas, the team of tracers took part in a large number of markings, highly contributing to knowing the dynamics of underground waters in all areas of carbonate waters in Romania. In this team there were and there are following researchers: R. CATILINA, S. CRĂCIUN, LUCREŢIA DINESCU, R. GAŞPAR, M. MIDOIU, MARIA PASCU, B. PĂUNICĂ, G. POPOVICI, C. STANCA, P. STĂNESCU, T. TĂNASE, L. TIMOFTE.

E. GAŞPAR is the author of "Modern trends in tracer hydrology" (1987) and "Tracers in aquifer systems" (1994), reference books in using tracers in hydrology. He has also published, on his own or with other co-authors, several articles on results of tracer tests and was constantly interested in finding new labelling technologies and new tracers to explore the dynamics of underground waters.

Hydrogeological research of karstic areas to point out still waters is the topic of articles published by M. PASCU, C. MOISSIU and ALINA MOISESCU in 1984 (Scropoasa supplies, Izvorul Minunilor at Stâna de Vale, Bârza-Topleţ and Murighiol), EUGENIA PÂRVĂNESCU and A. PÂRVĂNESCU in 1991 ("Şapte Izvoare Reci", Scropoasa area), ILEANA TIŢA and V. MICULA in 1998 („Hera spring" in Vlădeasa Massif) and I. ORĂŞEANU the same year (Bihor Vlădeasa and Codru Moma mountains).

Starting with 1983, the review "Theoretical and Applied Karstology" is being published, with works presented at seminars on this topic, organised by Emil Racoviţă Institute of Speology and S.C. Prospecţiuni S.A. In 1987, E. GAŞPAR and I. ORĂŞEANU publish in this series an article about natural and artificial tracers used in the study of karst hydrodynamics, A. IURKIEWICZ and A. MANGIN publish in 1994 a synthesis of using the systemic analysis in the study of karstic aquifers in Vâlcan mountains, while in 1995, A. ŢENU and F. DAVIDESCU publish another synthesis on using the environmental isotopes in the study of carbonate karstic aquifers in Romania. In 1991 and 1996, I. ORĂŞEANU publishes in the same review hydrogeological maps at 1:50,000 scale, of Pădurea Craiului and Bihor Vlădeasa Mountains.

In 1985, the Geological Institute of Romania publishes the Vaşcău sheet of the hydrological map of Romania, at 1:50,000 scale, drafting by GH. PONTA, M. BLEAHU, S. PANIN and I. ORĂŞEANU.

In 2002, A. ISTRATE, in the "Hydrokarstic systems of Bucegi Mountains" publishes the results of his research in the high watershed of Ialomiţa river.

The knowledge of karstic hydrographs of Apuseni Mountains was supported by a major contribution of works undertaken by L. VĂLENAŞ, B. ONAC, P. COCEAN, E. SILVESTRU and P. E. DAMM.

We also need to mention the key contribution in exploring and researching the karst in Romania of amateur speleologists. In many cases, the caves and avens they have found supported the researchers in exploring this invaluable asset.

Hydrogeological knowledge of karst areas were the object of PhD Thesis performed by T. RUSU (1979), A. ŢENU (1979), N. PITU (1981), I. POVARĂ (1997), V. MOLDOVEANU (1999), I. ORĂŞEANU (2000), G. ISTRATE (2001), A. IURKIEWICZ (2004), and A. ROTARU (2009).

The largest karst springs in the Carpathian Orogene have 1-2 m^3/s average flow rates (table 1), their occurrence being related to the presence of unary karst type systems, with homogeneous limestone bodies extending over large surfaces (the springs in downstream gorges of Dâmboviţa stream, Ochiu Beiului spring in Banat Mountains, Boiu spring in Vaşcău Plateau), or to of a widely developed non-karst catchment area within the binary karst systems (Cerna spring, Bârza spring, springs in Vâlcan Mountains). In Apuseni Mountains, although carbonate rocks extend over large areas, the tectonic structural pattern to which they had been subjected has resulted in a kaleidoscope-like structure, where carbonate deposits are scattered within the bulk of other deposits. This structural framework did not favor the development of large extent karst systems, so that flow rates of the most important springs do not exceed 500-600 l/s as mean annual discharge.

The largest distance between sinking points and outlets, recorded as a result of the tracer tests performed in Romania so far, is 23.6 km (table 2). It was reached along the connection between losses of Cerna river in Bobotului gorges and Neptun springs in Băile Herculane spa (G. SIMION, E. GASPAR, 1976). The flow path between the sinking point of Prejna stream in Mehedinţi Plateau and Bârza spring in Mehedinţi Mountains is 22.0 km long (G. BANDRABUR et al,1998-1999), thus being the second longest.

The higher difference in level recorded as a result of the performed tracer tests is 775 m between Balta Cerbului ponor and Seven Cold Springs in Mehedinţi Mountains (I. POVARĂ, 1980), followed by 700 m elevation drop between Scorota ponor in Retezat Mountains and Cerna spring in Godeanu Mountains (G. PONTA et al., 1984).

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No.	Source	Morphologic unit	Q mean	Q min	Q max	n_v	Bf	Period of observation	References
			m³/sec						
1	Cerna	Cerna Mountains	1.985	0.6	5.70	9.5		XI.1981-XII.1982	A. Bulgăr et al., 1984
2	Bârza	Mehedinţi Mountains	1.755	1362	3.17	2.3	0.621	X.1997-IX.1998	G. Bandrabur et al,1998-1999
3	Izvarna	Vâlcan Mountains	1.571	0.722	4.76	5.6	0.5-0.9	1957-1964	A. Iurkiewicz, A. Mangin, 1994
4	Pătrunsa	Vâlcan Mountains	1.493	0.146	5.62	38.5	0.240	1971-1972	A. Iurkiewicz, A. Mangin, 1994
5	Vâlceaua	Vâlcan Mountains	1.181	0.240	3.2	13.3	0.25-0.7	1957-1964	A. Iurkiewicz, A. Mangin, 1994
6	Jaleş	Vâlcan Mountains	0.964	0.190	3.58	18.8	0.25-0.7	1971-1972	A. Iurkiewicz, A. Mangin, 1994
7	Springs in Cheile de Jos ale Dâmboviţei gorges	Dâmbovicioara trench	0.800***					X.1979-IX.1980	I. Orăşeanu et al., 1984
8	Ochiu Beului	Banat Mountains	0.712	0.156	9.46	60.0	0.200	1973-1974	Iurkiewicz & Orăşeanu 1995
9	Boiu spring	Vaşcău Plateau	0.587	0.070	5.40	77.1	0.140	X.1997-IX.1998	I. Orăşeanu, 2000
10	Galbena	Bihor Mountains	0.550**					X.1984-IX.1985	I. Orăşeanu, 1996
11	Tăuz	Bihor Mountains	0.529	0.068	4.64	62.2	0.310	X.1984-IX.1985	I. Orăşeanu, 1996
12	Roşia	Pădurea Craiului Mts.	0.522	0.078	14.30	183.0	0.201	X.1982-IX.1983	I. Orăşeanu, 1991
13	Bigăr	Banat Mountains	0.483	0.042	3.2	76.0	0.219	1973-1974	Iurkiewicz & Orăşeanu 1995
14	Păuleasa	Bihor Mountains	0.477	0.180	1.92	10.7	0.416	X.1984-IX.1985	I. Orăşeanu, 1996
15	Ovid+Muncel springs	Mehedinţi Plateau	0.423*	0.061	1.07	17.5	0.31-0.42	1978-1987	A. Bulgăr, unpublished data
16	Scropoasa	Bucegi Mountains	0.406*	0.210	0.980	1.9	0.492	1980-1983	A.Istrate
17	Şura Mare cave	Sebeş Mountains	0.378	0.108	1.44	13.3	0.431	X.2002-IX.2003	G. & R. Bandrabur, present volume
18	Aştileu	Pădurea Craiului Mts.	0.356	0.074	3.41	46.0	0.303	X.1982-IX.1983	I. Orăşeanu, 1991
19	Izbândiş	Pădurea Craiului Mts.	0.346	0.049	3.98	81.2	0.171	X.1982-IX.1983	I. Orăşeanu, 1991
20	Gâlgoaie	Dâmbovicioara trench	0.318	0.180	0.430	2.4	0.722	X.1979-IX.1980	I. Orăşeanu et al., 1984
21	Brătcanilor	Pădurea Craiului Mts.	0.305	0.068	2.41	36.0	0.404	X.1982-IX.1983	I. Orăşeanu, 1991
22	Alunu Mic	Vlădeasa Massif	0.306	0.002	3.16	1580	0.088	X.1984-IX.1985	I. Orăşeanu, 1996
23	Izverna	Mehedinţi Plateau	0.301	0.038	2.25	59.3	0.230	X.1997-IX.1998	G. Bandrabur et al, present volume
24	Boga	Bihor Mountains	0.300**					X.1984-IX.1985	I. Orăşeanu, 1996

n_v, (Qmax /Qmin); B_f, base flow index (the ratio between Qmean of the drought month and Q mean annual).

*) cumulated flow;

**) expeditionary measurements;

***) data processing in Podu Dâmboviţei and Rucăr hydrometric sections.

Table 1. Largest springs in Romanian Carpathian Orogene karst areas (mean annual discharge more than 300 l/s)

No.	Insurgence		H, m	Resurgence		H, m	L, km	ΔH, m	Tracer	T, hours	V, km/day	Year	Author (s) of labelling	References
A														
1	Bobonului gorges	Godeanu Mts.	375	Neptun Springs	Cernei Mts	148	23.60	227	T			1976	G.Simion, E.Gaşpar	Simion, 1988 *)
2	Prejna stream	Mehedinţi Plateau	450	Bârza Spring	Mehedinţi Mts.	180	22.00	270	F	456	1.15	1998	G.Bandrabur, D. Slăvoacă	Bandrabur et al,1998-1999
3	Bălta stream	Vâlcan Mts.	420	Isvarna Spring	Vâlcan Mts.	200	19.70	220	In	336	1.40	1991	A.Iurkiewicz, E.Gaşpar	Iurkiewicz, Mangin, 1994
4	Bistriţa stream	Vâlcan Mts..	325	Isvarna Spring	Vâlcan Mts.	200	15.60	125	In	168	2.23	1985	D. Rădulescu, E. Gaşpar	Rădulescu et al., 1987
5	Scorota ponor	Retezat Mts.	1410	Cerna Spring	Godeanu Mts.	710	13.35	700	In	240	1.33	1982	(1)	Ponta et al., 1984
6	Şuşiţa Verde stream	Vâlcan Mts.	437	Balaure Spring	Vâlcan Mts.	285	12.70	152	In	264	1.15	1990	A.Iurkiewicz, E.Gaşpar	Iurkiewicz, Mangin, 1994
7	Iuta creek	Cernei Mts.	370	Seven Cold Springs	Cernei Mts..	200	12.40	170	I, F	177	1.68	1978	E. Gaşpar et al.	Povară, 1980
8	Jidanul (Caprei) creek	Vâlcan Mts.	1185	Cerna Spring	Godeanu Mts.	710	12.10	475	F	282	1.03	1975	I. Povară et al	Povară, 1980
9	Pestişului stream	Păd.Crai. Mts.	325	Aştileu Spring	Păd. Craiului Mts.	250	11.55	75	In	2040	0.13	1983	I.Orăşeanu, E. Gaşpar	Orăşeanu et al.,1991
10	Ursului creek	Vâlcan Mts.	1180	Cerna Spring	Godeanu Mts.	710	10.95	470	F	228	1.15	1974	Constantinescu, et al	Povară, 1980
11	Poienile Ţesnei ponor	Cernei Mts.	320	Hercules Spring	Cernei Mts.	155	10.25	165	I	210	1.17	1979	G.Simion, E.Gaşpar	Povară, 1980
12	Pârgavu stream	Vâlcan Mts.	370	Isvarna Spring s	Vâlcan Mts.	200	10.00	170	In	216	1.11	1985	D. Rădulescu, E. Gaşpar	Rădulescu et al., 1987
13	Ştirbu creek	Vâlcan Mts.	1170	Cerna Spring	Godeanu Mts.	710	9.90	460	F	268	0.89	1974	I. Povară et al.	Povară, 1980
14	Izvorele ponor	Mehedinţi Mts.	580	Baia de Aramă catchment	Mehedinţi Plateau	275	9.32	305	In	368	0.61	1989	G. Diaconu, E. Gaspar	Diaconu, 1989 *)
15	Gorganu creek	Mehedinţi Plateau	495	Bolborosu Spring	Mehedinţi Plateau	280	8.65	215	I	96	2.16	1970	(2)	Slăvoacă et al., 1985
16	Poienii stream	Păd.Crai. Mts.	390	Aştileu Spring	Păd. Craiului Mts.	250	8.35	140	In	768	0.27	1983	I.Orăşeanu, E. Gaşpar	Orăşeanu et al., 1991
17	Ponor of Priga creek	Vaşcău Plateau	640	Sfărăşele Spring	Vaşcău Plateau	295	8.30	345	I	168	1.21	1987	I. Orăşeanu	Orăşeanu, 2000
18	Şuşiţa Seacă, up.Tălnicioara	Vâlcan Mts.	450	Balaure Spring	Vâlcan Mts.	285	8.20	165	Dy			1990	A.Iurkiewicz, E.Gaşpar	Iurkiewicz, Mangin, 1994
19	Losses of Sfăraş creek	Vaşcău Plateau	667	Boiu Spring	Vaşcău Plateau	300	8.025	367	In	1632	0.12	1897	I. Orăşeanu	Orăşeanu, 2000
20	Poienile Ţesnei ponor	Cernei Mts.	320	Seven Hot Springs	Cernei Mts.	169	7.62	151	I	145	1.26	1979	G.Simion, E.Gaşpar	Povară, 1980
21	Ponor of Fântâna Lotrilor	Vaşcău Plateau	613	Boiu spring	Vaşcău Plateau	300	7.60	331	I	216	0.62	1978	(3)	Orăşeanu, 2000
22	Motru Sec stream	Mehedinţi Plateau	350	Bolborosu Spring	Mehedinţi Plateau	280	7.40	70	In	120	1.48	1983	(2)	Slăvoacă et al., 1985
23	Poiana Muşuroaie	Mehedinţi Mts.	870	Bârza spring	Mehedinţi Mts.	240	7.20	630	I	168	1.03	1979	I. Povară, E. Gaşpar	Povară , 1980
24	Şuşiţa Seacă (quarry area)	Vâlcan Mts.	400	Balaure Spring	Vâlcan Mts.	285	7.20	115	In			1990	A.Iurkiewicz, E.Gaşpar	Iurkiewicz, Mangin, 1994
25	Cuceş ponor	Reşiţa-Moldova zone		Bigăr Spring	Reşiţa-Moldova N		7.00	390	F	432	0.38	1976	V. Sencu	Sencu, 1986
B														
1	Balta Cerbului ponor	Mehedinţi Mts.	950	Seven Cold Springs	Mehedinţi Mts.	175	1.85	775	F	40	1.10	1978	I. Povară	Povară, 1980
2	Scorota ponor	Retezat Mts.	1410	Cerna Spring	Godeanu Mts.	710	13.35	700	In	240	1.33	1982	(1)	Ponta et al., 1984
3	Muncelu cave	Bihor Mts.	1100	Blidaru Spring	Bihor Mts.	435	3.88	665	I	147	0.631	1985	(4)	Orăşeanu et al., 1991
4	Poiana Muşuroaie	Mehedinţi Mts.	870	Bârza spring	Mehedinţi Mts.	240	7.20	630	I	168	1.03	1979	I. Povară, E. Gaşpar	Povară, 1980
5	Vărăşoaia ponor	Bihor Mts.	1290	Boga Spring	Bihor Mts.	675	2.17	615	B	15	0.347	1985	(4)	Orăşeanu et al., 1991
6	Ponor of Mohilii creek	Mehedinţi Mts.	1050	Isverna Cave	Mehedinţi Mts	450	2.55	600	F	137	0.394	1979	I. Povară	Povară, 1980

H-elevation, in meters a.s.l., L-horizontal distance between losses and Spring s, DH-Difference in level between insurgence and resurgence; T-time of first arrival of tracer; V-apparent velocity. Tracers: T= Tritium; F=Fluoresceine, R=Rhodamine B, I=I-131,In= In-EDTA, Dy=Dysprosium EDTA.

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Table 2. Largest lengths (A) and difference in level (B) recorded in tracing operations performed in Romanian Carpathian Orogene karst areas

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