TOURISM IN ICELAND: PHASE TWO VOLUME TWO, BOOK SIX

MEDICAL HYDROLOGY IN ICELAND

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I. MINERAL WATERS AND THERMAL CURE

A. Definition of Mineral Waters

The difference between mineral waters capable of exercising an effect on man's health, and those from an ordinary source devoid of such an effect, is intuitive. There does not at present exist a "legal" definition of mineral waters which is internationally accepted. Most countries have their own particular legislation on the subject but neither the definitions, nor the regulations are identical.

Certain common points are found, however, in all of these legislations, the principal being that the mineral water is always considered as being a natural water obtained from natural or artificially opened springs. Virtually all of the legislations are also in agreement that these waters must be used without physical or chemical treatment, as this could alter their complex physico-chemical equilibrium, and as a result, modify their properties.

The legislations, on the other hand, are not in agreement as to the basic characteristics which differentiate mineral waters from simple natural waters.

Three principal criteria can effectively be used in classifying mineral waters:

1. Temperature

The temperature criterion refers to the temperature of the water at the moment that it leaves the spring.

In practice, this characteristic is no longer actually taken into consideration for the definition of mineral waters. On the

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other hand, the term "thermality" for a spring water corresponds to this notion of temperature. It is thus that one distinguishes the springs whose waters are:

• cold	: under 25° C)	- constituting the hypothermal waters
• temperate	: 24° C - 28° C)	
• tepid	: 29° C - 35° C)	
• hot	: 36° C - 45° C	- thermal waters
• very hot	: over 46° C	- hyperthermal waters

The mineral waters can in fact fall into each one of these different categories and the following examples, taken from among several thermal resorts of an international character, show this fact well:

HYPOTHERMAL WATERS (less than 36° C)

VITTEL (France) Grande Source	11° C
MARIANSKE LAZNE (Czecho-Slovakia) Source Ambroz	12° C
MONTECATINI (Italy) Source Tettuccio	24.6° C

THERMAL WATERS (36° C - 45° C)

VICHY (France) Source Grande Grille	42.5° C
VICHY (France) Source Chomel	41.8° C
AIX-LES-BAINS (France) Source Soufre	41.7° C

HYPERTHERMAL WATERS (more than 45° C)

PLOMBIERES (France) Source des Dames	52° C
KARLOVY VARY (Czecho-Slovakia) Source Mlynsky	49° C
BADEN-BADEN (West Germany)	58 - 63° C
ABANO (Italy)	87° C

The temperature of the spring water cannot therefore constitute a basic criteria for the definition of mineral waters. On the other hand, this temperature can constitute an interesting element for the use of certain hydrotherapeutic techniques. These apparently curative values defining thermal waters (36° C - 45° C) were, in fact, simply determined because they roughly correspond to a water which can be used directly for the bath.

2. Mineralisation

Mineralisation refers to the overall quantity of dissolved substances (expressed in mg per litre), and is a criterion adopted by the legislations of numerous countries for the classification of mineral waters.

Most often the values retained are the following: the natural spring waters containing more than 1000 mg/l of dissolved substances, or more than 250 mg/l of carbon dioxide are mineral waters.

This definition rests on the quantitative criteria to differentiate mineral waters from simple spring waters.

In practice, experience shows that numerous natural spring waters, whose overall mineralisation is inferior to this minimum quantity, possess nevertheless interesting medical properties - as shown below for some of the well-known spa resorts:

PLOMBIERES (France) - Source des Savonneuses	0,153 g/l
" (France) - Source des Dames	0,274 g/l
BEPPU (Japan) - Onken Spring	0,300 g/l
EVIAN (France) - Source Cachat	0,304 g/l
ARIMA (Japan)	0,500 g/l
AIX-LES-BAINS (France) - Source Alun	0,512 g/l
RADIUM HOT SPRINGS (Canada)	0,800 g/l
VITTEL (France) - Grande Source	0,832 g/l
NOBORIBETSU (Japan)	1,000 g/l

3. Physiological Activity

A certain number of countries have adopted legislation in which a qualitative criteria is preferred.

According to these legislations, natural spring waters possessing therapeutic properties are mineral waters. The term therapeutic must be taken here in its largest sense, that is to say that these waters can exercise a favorable effect on the health, i.e. for a curative or a preventive purpose.

4. Case of the Icelandic Waters

It is interesting to consider how to treat the principal Icelandic springs as a function of the three base criteria, even if the first does not have a direct legislative interest.

For this comparison, we have used the analyses of the spring waters in Volume II (Technical Background) of Tourism in Iceland completed in January 1973 by Checchi and Company (Tables I G 9 to I G 22).

a) As a Function of the Temperature

The 139 springs analysed in the tables are thus distributed:

- Hypothermal springs : 8
  - cold : 4
  - temperate : 2
  - tepid : 2
- Thermal springs : 4
- Hyperthermal springs : 127

There appears to be a great preponderance of very hot springs in Iceland. It is moreover probable that the inventory of Icelandic springs is far from complete, and that the analytic efforts have been carried out in the main on the hottest waters whose utility goes far beyond the scope of medical science, i.e. domestic heating or generation of electricity.

b) As a Function of the Mineralisation

One only considers here the overall mineralisation, that is to say the total quantity of dissolved substance, without taking into account the characteristic of this chemical composition which will be considered in the following chapter.

The study of the 139 springs, the analyses of which have been submitted to us, shows a very variable mineralisation, the extremes of which are thus:

- the most mineralised : 72,39 mg/l (table I G 10)
- the least mineralised : 0,086 mg/l (table I G 21)

If the range is very large, one remarks, however, that there is a strong predominance of springs whose waters are feebly mineralised. Exhibit VI-1 indicates this distribution.

If one takes the limit of 1 g/l, the value retained by most of the legislations relying on a quantitative criteria, the distribution of the springs analysed is situated thus:

- 107 springs whose overall mineralisation is less than 1 g/l.
- 32 springs whose mineralisation is more than 1 g/l.

Consequently, therefore, in the sense of this quantitative criteria, most of the Icelandic spring waters would not be mineral water springs.

It is interesting to study the distribution of this overall mineralisation for the feeble concentrations. Exhibit VI-2 gives this distribution for all the springs having an overall mineralisation of less than 2 g/l. One can see here that the mineralisation of most of the springs is located around 0,4 g/l, that is to say in practice far from the limit of 1 g/l.

EXHIBIT VI-1

DISTRIBUTION OF MINERALISED WATERS IN ICELAND BY GRAMS/ LITER (g/l)

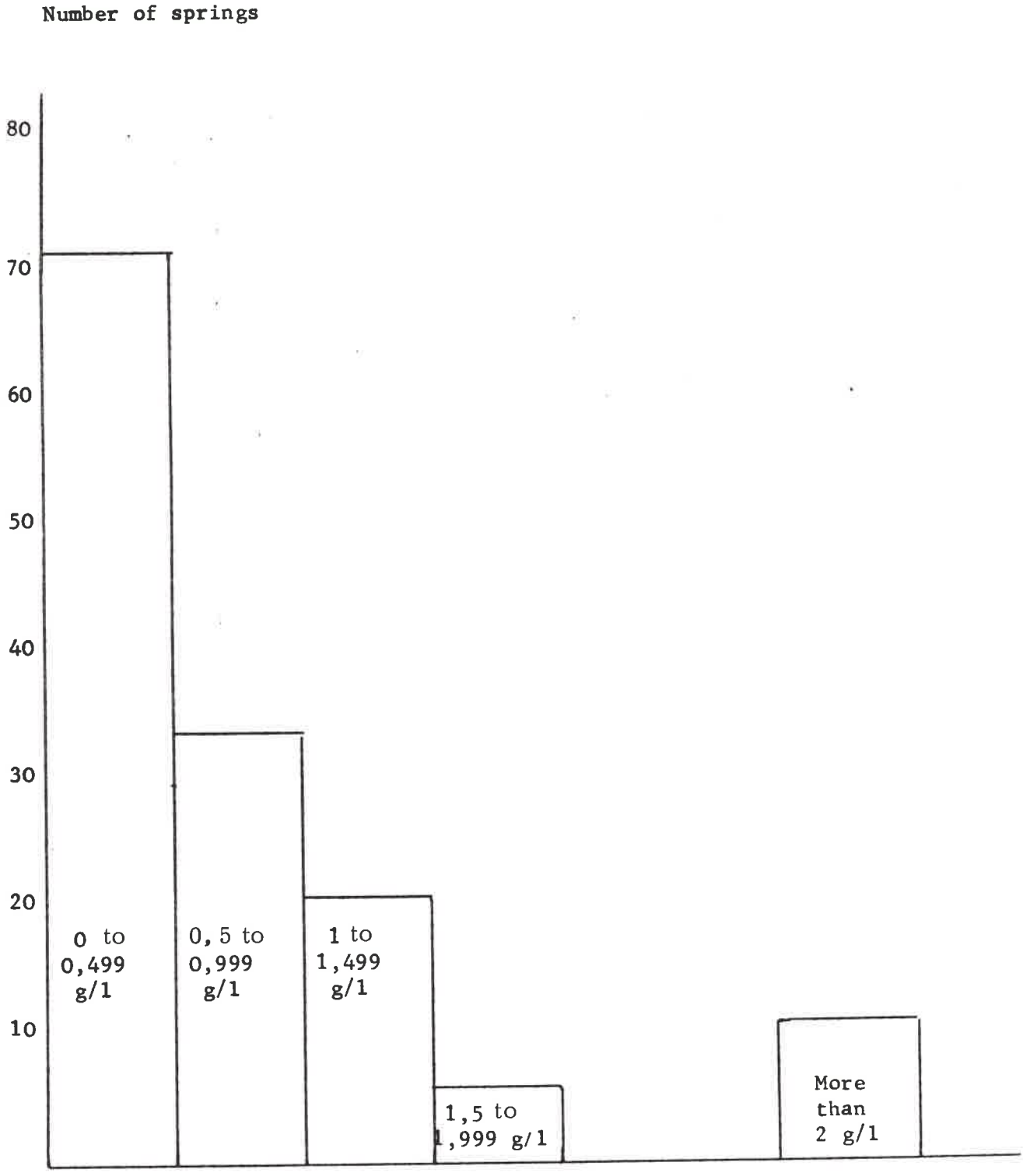
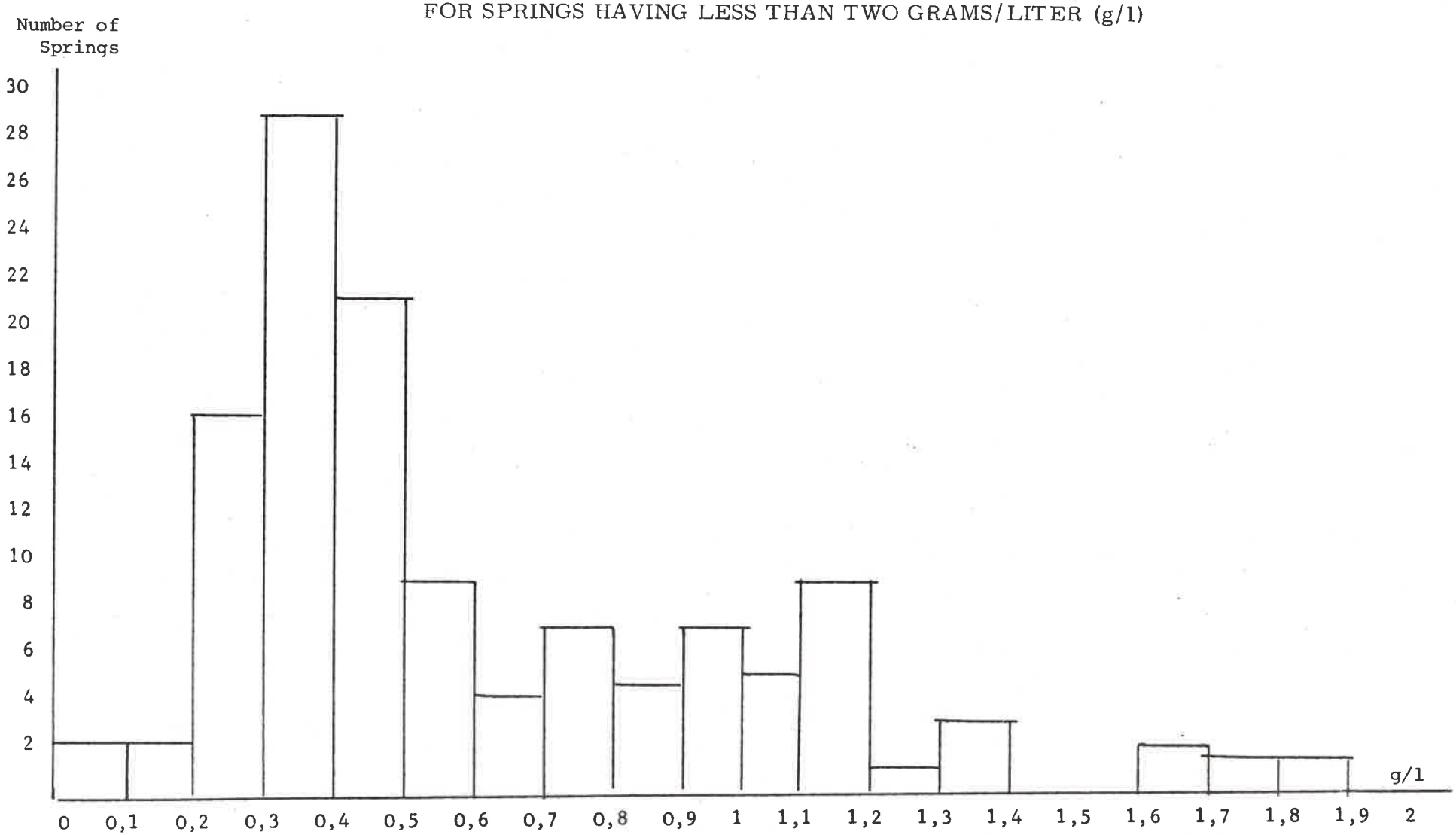


EXHIBIT VI-2

DISTRIBUTION OF MINERALISED WATERS IN ICELAND
FOR SPRINGS HAVING LESS THAN TWO GRAMS/LITER (g/l)



c) As a Function of the Activity

Studies related to the physiological properties of these Icelandic spring waters are rare. In practice only certain springs in the region of Hveragerdi are used for certain medical purposes. A detailed study will be devoted to the resort in the second part of this report.

It appears therefore necessary, in order to determine the eventual properties of these springs, to refer to the present state of the problem and make comparisons with the principal springs exploited in other countries. One can, equally, for this study, rely upon the chemical classification of the mineral waters and the therapeutic applications of each of the broad categories.

5. Practical Consequences

It does not appear that until now, Iceland has been occupied by the question of legislating the exploitation of mineral waters.

Should the use of these waters grow internally or internationally, it will be necessary for the Icelandic Government to fill this gap.

As far as the definition is concerned, it is evident from the foregoing that it would be most advisable to choose a definition relying on the qualitative criteria rather than on the question of the overall mineralisation.

It is worth pointing out, on this matter, that diverse efforts are being made to establish a broader definition of mineral waters. On the one hand, the organisations of the European Common Market are attempting to launch a definition which could become common to all the countries of the European Economic Community. Since European legislations today vary considerably, leaning on the one or the other of the two principal criteria analysed above, any new European definition could only be a compromise between the two. On the other hand, the Food and Agriculture Organisation is trying to propose a definition of mineral waters which could be common to all the countries who are members of the United Nations. Any one of these two attempts at more systematic and uniform classification of thermalism could be adopted by Iceland.

However, the Iceland legislation to be established should not limit itself to one definition of mineral waters. It should deal equally with a certain number of other points such as:

- the conditions of catchment of the springs
- the conditions of exploitation of the springs
- the nature of periodic control of the catchment of the waters.

Those are technical problems on which specialists will have to be consulted.

B. The Modern Conception of the Thermal Cure

The use for curative or preventive medical purposes of the mineral waters leads to the notion of a thermal cure.

There is not in effect, of course, a thermal cure without the use of mineral water taking an important part, according to the internal or external techniques which are at present numerous and adapted to the different clinical cases.

The derivatives of the mineral waters (mud, vapours, and gas in particular) are also generally used for thermal cures. It should be noted on this matter that it is equally possible to associate with certain cures the use of marine derivates (plankton or lichen for example).

However, the modern conception of the thermal cure is not limited only to the use of mineral water and its derivatives. In a complete regimen these two elements are coupled with supplementary treatments amongst which one can cite climatic factors, the use of physical processes (massages, reeducation) relevant to physical medicine, diet, and also the psychological elements (the patient's removal from his usual surroundings, distractions, etc.).

This broad conception of the thermal cure is very important in the framework of a project for the development of thermalism in Iceland. It is in effect certain that the mineral waters of this country, if they are very interesting, could not however be considered as unique in the world; springs with similar properties exist in other parts of the globe. Consequently, on the sole aspect of the use of the mineral waters, the Icelandic thermalism cannot at first sight claim characteristics without equivalence elsewhere. On the contrary, it is in the enlarged conception

of the thermal cure, bearing in mind all of the above enumerated factors, that Icelandic thermalism can lay claim to a specific character.

1. The Techniques of the Use of the Mineral Water and of Its Derivatives

It would not be possible within the framework of this report to envisage in detail all of the techniques of use of the mineral waters and of their derivatives. It will suffice therefore to bring to mind the main ones:

- the bath (individual or in a swimming pool, in stagnant or running waters with total or partial immersion)
- the shower (with numerous variations depending on the temperature and the pressure of water)
- the vapour bath of mineral water (natural or artificial)
- the applications (total or partial) of mud or lichen
- the medical techniques for certain specific illnesses (intestinal irrigations, aerosols, etc.)

These indications of the principal techniques are meant only to show that the thermal installations cannot be polyvalent and that it is therefore necessary to determine beforehand the afflictions to be treated in order to establish the technical plan of the installations.

2. The Principal Supplementary Elements and Their Use in Iceland

It is also not possible, in the framework of this report, to consider in detail all the associated elements. In effect, their precise choice depends in particular on the geographical location chosen for the settlement and the medical indications which will be defined for each resort.

The problem of distractions will not be discussed in this chapter. These are a very secondary element, but nevertheless important for the patients' stay in the establishment. This question is above all to be considered for the case of a set of international treatments, and this will be considered in more detail in the next chapter.

Among the principal secondary elements to consider other than distractions, one can distinguish:

a) Diet

These are important for most of the patients susceptible to benefit from a thermal cure.

If the dietetic directions are of a medical nature, this presupposes that the medical staff attached to the establishments will be educated in this sense. The "restaurant" part of the residential areas must also be conceived in such a manner that the menus can be adapted to the medical prescriptions of this field.

b) Massage

An installation permitting all the sorts of massages must equally be foreseen. These massages can be aided by mineral water (massage under water, which necessitates tables with hand-rails, permitting a shower of the patient with mineral water during the massage), or the simple classic dry massages.

c) Sauna

The installation of a sauna is generally useful, irrespective of the type of patient. This installation appears particularly important in the case of a thermalism in a Scandinavian country where such practices are very much used (in Norway, Sweden and Finland in particular, countries of potential clientele).

d) Exercise and Physical Therapy (Reeducation)

In the extent that certain resorts will appeal to the patients suffering from osteo-articular troubles, reeducation installations must be considered. These, to be complete, must include a reeducation swimming pool (of the type, for example, of a swimming pool to enable handicapped patients to walk, introduced in France by Dean Denis Leroy, and a reeducation room, on fixed apparatus.

For the resorts receiving other patients, it could be useful to consider a gymnasium with equipment.

e) Climatic Factors

This must include the possibility of employing the "climatic stress" special to the Icelandic climate.

Such is, by example, the case of the open air swimming pool heated by thermal water. It is important in this case to foresee installations such that the patients can enter into the water in a heated part (micro climate), and reach by water (by foot or swimming) the external pool. Such a disposition removes the discomfort of an exposure to the exterior air in a bathing costume, which is uncomfortable during cold weather.

3. The Duration of the Thermal Cure

Classically, the duration of the thermal cure is three weeks. This arrangement effectively corresponds to medical reasons that would be too long to discuss here. Certain resorts, in particular in Italy, have, however, been orientated for several years towards the possibility of a shorter cure of about 10 days.

In fact, even if the general principal of the three-week cure must be applied in Iceland, it would appear logical to conceive shorter cures for an international resort. This would be justified by the fact that numerous patients would come for preventive cures or for health maintenance, complementarily to another treatment.

II. ICELANDIC HYDROTHERMAL RESOURCES

A. The Classification of the Mineral Waters

The mineral waters are, by definition, the waters having favorable effects on the health. Their use will,therefore,be interesting in the medical field, and classification will only be of interest to the extent that it will unite in the same groups the mineral waters having the same therapeutic uses.

It would, therefore, appear logical to form a classification relying on the therapeutic uses: waters active on the digestive system, waters active on the cardio-vascular system, etc.

In practice,such a classification would appear difficult for numerous reasons. In particular, it would not be possible except to the extent that each mineral water had first been tested on animals and on man, which is not always the case, at least at the beginning. It is in effect necessary, in order to be able to proceed with these experiments under good conditions, to have from the beginning an orientation on the possible activities.

On the other hand, one generally admits that the mineral waters do not always intervene, as do most chemical medications, directly on an organ or a function of the organism. Most often the experiments have shown an action of the mineral waters on the major physiological regulatory functions of the organism: an effect on the neuro-vegetative equilibrium, an effect on the calcium metabolism, etc.

So the most common mineral water classification today relies not on the medical use but on the chemical composition. In practice, moreover, these two criteria are not completely foreign. In effect, it is evident that the action of a mineral water on the organism is largely dependent on its chemical composition and in particular the principal elements which characterise its mineralisation.

1. The Chemical Classification

A mineral water is a complex medium, and its overall mineralisation is always due to the presence of numerous different dissolved substances.

The chemical classification will, therefore, bring to mind not a quantitative element (overall mineralization), but a qualitative element (predominant element).

For reasons of biological activity, the classification relies on the negatively charged ion element (anion predominant). These are are in effect the elements showing, biologically speaking, the most activity on the organism.

One has, therefore, determined four principal classes:

- The bicarbonated waters whose principal element is the CO_3H^- ion. These waters can be subdivided according to the nature of the cation (electro-positive element) predominant in sodium, calcium and mixed bicarbonates.

- The sulphated waters whose principal element is the SO_4^- ion. Biologically, the sulphur in these waters is not directly usable by the organism and their medical interest in practice is linked, above all, to the nature of the associated cation. One thus distinguishes in this group of sub-classes: calcium and magnesium bicarbonates, which contain very little sodium, and the sodium bicarbonates.

- The chlorated waters whose principal element is the Cl^- ion. This is generally present in the form of sodium chloride, and these waters are sometimes called for this reason: sodium chlorides. The sub-classes are founded on the total dose of sodium chloride present in the water: feeble (less than 10 g/l), average (10 - 50 g/l), and strong (more than 50 g/l).

- The sulphuretted waters whose principal element is the SH^- ion. Unlike the sulphated waters, the sulphur element here is directly usable by the organism and the nature of the associated cation is of little importance for the medical use of these waters. The sulphurated waters are always accompanied by a release of SH_2 gas with very characteristic odors, easily detectable around the springs.

In a certain number of cases, the chemical analysis of the mineral waters does not show the predominant element. Such is the case of many waters only having a feeble overall mineralisation. It is fitting, therefore, to add to the four preceding categories a fifth, called the undetermined waters, which corresponds to this lack of a predominant element.

EXHIBIT VI-3
CHEMICAL CLASSIFICATION OF MINERAL WATERS

MINERAL WATERS CHEMICAL TYPE	PRINCIPAL PHYSIOLOGICAL PROPERTIES	PRINCIPAL MEDICAL USES
Bicarbonated waters	Stimulating action on the hepatic function	Gastro-intestinal illnesses
	Stimulating action on the intestinal motivity	Hepatic insufficiency
	Action on certain general metabolisms (excretion of uric acid, hypoglycemiating effect,...)	Gout
Sulphated waters	Diuretic action	Gastro-intestinal illnesses
	Stimulating action of the biliary function	Hepatic insufficiency
	Stimulating action on the intestinal motivity	Problems with the accumulation of organic waste
Sodium chlorinated waters	Stimulation of the growth	Pediatry
	Stimulation of cicatrizations (osseous tissue in particular)	After effects of osteo-articular traumatisms Chronic infections of the mucous membranes
Sulphuretted waters	Trophic effects on the skin and mucous membranes	Chronic infection of the mucous membranes (O.R.L. in particular) Rheumatology
	Antalgic, antispasmodic action	Rheumatology All spasms (digestive in particular) Metabolic illnesses (gout, lithiasis...)

This classification has the advantage of giving an indication as to the medical use of the mineral waters. The very general correspondences are indicated in Exhibit VI-3. Of course, these medical indications must be specified for each spring which will entail an adoptation of the techniques to be applied.

Finally, it is evident that this classification can undergo modifications to the extent that certain mineral waters contain substances which are in the minority, quantitatively speaking, but highly active biologically speaking. Such is the case, for example, of the waters containing iron or arsenic whose particular use will be more linked to the presence of these elements than to their chemical class.

Equally, the radioactivity of mineral waters must be taken into consideration. This can, in effect, play an interesting physiological role (see the case of undetermined waters in Exhibit VI-3) and it is equally important to ensure that the strength of this radioactivity does not entail toxological risks for the patients exposed to it.

2. The Derivatives of The Mineral Waters

It is fitting to say that the derivatives of the mineral waters (muds and gas) can also have an interesting medical use and that a knowledge of them is, therefore, important.

B. The Icelandic Mineral Waters

1. Chemical Composition of The Icelandic Mineral Waters

It is possible to develop a general idea on the interest and the principal uses of the Icelandic mineral waters by studying their chemical composition and trying to class them following the major categories previously indicated.

We had at our disposal the analyses of numerous springs carried out for the greater part in Iceland by Sigurdur R. Gudmundsson for Orlygur Halfdanarsson and reported in Volume II (technical background) of the report "Tourism in Iceland" produced in January 1973 by CHECCHI and Company.

These analyses are very interesting and were made under good conditions as was verified when a personal contact was made with Sigurdur R. Gudmundsson. It would therefore appear possible to establish a classification of the springs following the classical nomenclature.

It is fitting, nevertheless, to make two important reservations. Firstly, in the present state of the work there has been no systematic study of the composition of the gases of the springs. This observation is particularly important with regard to the SH_2 gas (hydrogen sulphide) which is a characteristic of the sulphurated waters. The quantity of the S element which has been systematically produced in the water only accounts imperfectly for the real percentage of the oxydizable sulphured elements which the mineral waters contain. This explains that looking only at the results of the chemical analyses, there appear to be no springs whose waters could be classed in the sulphured group. However, experience shows that during the visit which we made to different hot water sites, a notable odor of hydrogen sulphide is perceptible at numerous places.

A second reservation concerns the absence of measurement of radioactivity. During the meetings with the analyst, it appeared that these gaugings were possible in Iceland but that it had not been possible to systematically do them, owing to their difficulty, in the short time at their disposal. Certain analyses have been no doubt carried out since and the results should be sent to us later on.

If, therefore, a classification of the Icelandic mineral waters can be carried out, having regard to the preceding reservations, it is evident that when the choice of the eventual thermal sites is made, new complete analyses of the reserved springs will be necessary to be able to state more precisely their medical interest and their optimal conditions of use.

2. Distribution of the Analyzed Icelandic Mineral Waters

Having regard to the preceeding remarks, the distribution of the mineral waters analyzed in the Checchi report can be made in the manner indicated in Exhibit VI-4.

EXHIBIT VI-4

DISTRIBUTION OF MINERAL WATERS IN ICELAND BY CHEMICAL TYPE

Table	Number of sources	Bicarbonated			Sulphated		Chlorated			Sulphu-retted	Undeter-mined
		Sodium	Calcium	Mixed	Magnesium Calcium	With sodium	Feeble	Average	Strong		
I G 9	10	4			1	1	3	1			
I G 10	4							4			
I G 11	5					3	1				1
I G 12	3	2					1				
I G 13	12	7				4	1				
I G 14	1					1					
I G 15	11	1				10					
I G 16	14	5			1	4	4				
I G 17	1	1									
I G 18	24	2				5	11				6
I G 19	23					20	3				
I G 20	11	2				5	3				1
I G 21	12					10	1				1
I G 22	8	3			1	2	1	1			
	139	27			3	65	29	6			9

1/ References are to tables in Appendix I-G of Phase One report on Tourism in Iceland, Volume II: Technical Background (Checchi and Company, January, 1973)

It is fitting to stress that it is a question here of a theoretical classification destined only to give general indications. In effect, we have stressed, in the first part, that many of these waters only contain a feeble mineralisation. In certain cases, their classification in the undetermined group or that of the predominant ion is subject to debate. To the greatest possible extent, priority has, therefore, been given to qualitative element.

The first important observation from the examination of this table is a large variety of the Icelandic mineral waters. Apart from the sulphurated waters, which do not appear in the table for the previously indicated reasons (but which exist without any doubt), all the other categories of mineral waters are represented.

There is certainly in Iceland, a very large range of mineral waters and one can, therefore, consider, at first sight, that all the possibilities of classical thermalism can be found in this country.

The second observation is the very frequent presence of sodium in these waters apart from, of course, the sodium chlorinized waters. Rare are the waters which are bereft of it. This finding could appear troublesome as far as the medical use is concerned since numerous chronic patients are at present put on a sodium reduced diet. One must consider, however, that many of these waters are feebly mineralised and in consequence, the quantity of sodium which may be ingested by the organism may not finally be significant. This is particularly important for the bicarbonated and sulphated waters in particular which must be used in the form of an imbibed cure.

3. Comparison With Some French Sources

It can be interesting to compare the chemical composition of the Icelandic mineral waters with those of some springs which have been used medically for a very long time and which have an international reputation.

Exhibit VI-5 gives the composition of the waters of several major French springs used at Vichy, Contrexeville, Plombieres-les-Bains and Aix-les-Bains, four French resorts which all well known and each of which receives patients from numerous countries.

EXHIBIT VI-5

COMPOSITION OF MINERAL WATERS IN SELECTED FRENCH SPRINGS

ELEMENTS	BICARBONATED		MAGNESIUM AND CALCIUM SULPHATES		SULFATED AND BICARBONATED FEEBLY MINERALISED		SULFATED AND BICARBONATED AVERAGE	
	VICHY Grande Grille	Tab. I G 22 Lysuholl	CONTREXEVILLE Pavillon	Tab. I G 11 Engjahver	PLOMBIERES Dames	Tab. I G 9 Reykhus	AIX-LES-BAINS Alun	Tab. I G 16 Jokulgil
CO_3 H-	4 720,0	1 230,0	347,7	-	57,4	26,4	386,0	393,5
CL^-	348,0	101,0	11,1	1,0	6,0	13,3	19,9	19,1
Ca^{++}	105,0	46,0	509,5	77,2	8,8	3,2	92,4	17,8
Mg^{++}	11,0	26,6	48,6	69,0	1,1	0,5	20,0	5,7
K^+	95,2	31,1	3,8	2,8	4,3	0,8	2,8	8,4
Na^+	1 889,0	414,0	12,6	27,5	64,1	57,5	25,0	116,6
SiO_2	60,4	187,0	17,6	365	67,0	106	19,6	149
SO_4^{--}	189,7	27,4	1 130,8	792,7	66,2	48,5	130,0	106,2

One can see in this table that it is possible to find waters of the same type in the analyses of the Icelandic springs. Of course, the compositions are never perfectly identical but the type of these waters shows, nevertheless, that they are of the same family.

It is fitting, of course, to remember in these comparisons that the chemical analyses were not made in the same laboratory and that, in consequence, the dosage techniques used (as those for the collection of the water sample to be analysed) are without doubt, not exactly comparable.

One is struck for example, by the relatively high percentage of silica in the Icelandic mineral waters. Very generally, the percentage of this element nearly always passes that which one usually meets in the mineral waters of other regions. This is particularily visible in Table 6 where the composition of the Icelandic waters differs every time from those of the French springs in their high percentage of silica. This point would merit further precision when the study of the composition of the springs, considered worthwhile for exploitation for medical purposes, may be made.

This comparison with waters coming from much used springs in other countries of the world can only have a fragmentary character. It appears, nevertheless, interesting because it shows that in Iceland, one finds very varied mineral waters, the medical use of which can be very wide. It also confirms the fact that the Icelandic mineral waters cannot be separated, by their chemical composition from other known springs. As has been stated in the first part of this report, it may be confirmed that the eventual Icelandic thermalism could only be unique in the use of all of the factors which intervene in the cure and not by the sole specific quality of its waters.

C. The Natural Cure Sanatorium at Hveragerdi

The numerous Icelandic mineral water springs do not appear to be used at present for medical purposes except occasionally in a very local and always empirical way.

The only treatment center where these mineral waters are used effectively as one of the elements of the cure is the natural cure sanatorium at Hveragerdi, situated about 30 miles to the east of Reykjavik.