

Hand-out Vinyl Chloride Workshop

V.H.O. Lyon 24-25 June 1974

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P.V.C. is being produced by Royal Dutch Shell in its plant in Rotterdam - Pernis the Netherlands since 1949. Initially the production being a few hundred tons yearly, it gradually increased to 20,000 tons. The original plant was taken out of commission in early 1963 when a new one was started. The yearly output is now somewhere in the neighbourhood of 120,000 tons.

The process of the first plant was a continuous one with 5 reactors, each of which was opened and cleaned by waterjet every 3 weeks. The new plant which was commissioned in 1967 was on a batch process with initially 15 and now since 1972 a total of 32 reactors with a cleaning cycle of 12-15 hrs. Mid 1972 a suction gadget was installed over the manholes, to reduce drastically the amount of vapour when they are opened.

Cleaning is by waterjet as before.

Production of V.C.M. was stopped in July 1971. Ever since then it is being piped from a nearby plant, not belonging to our group.

Since 1949 a total of 359 process operators have been engaged on work with V.C.M. and P.V.C., of whom 101 less than a year, 49 less than 2, 22 less than 3, 16 less than 4, 32 less than 5, 52 from 6-10 yrs, 19 from 11-15 yrs and 8 longer than 20 yrs. Figure 2 shows how the present labour force is built up in 5 year age groups. 272 workers out of the total of 359 are still at work in our works at Pernis, 27 have been retired or went with resignation. Out of this group only one man died in February 1972 at the age of 40. He had been with the company 23 yrs. Cause of death was myelofibrosis and pancytopenia. From 1949 - 1955 he worked in the P.V.C. plant with exposure to V.C.M. D.C.A (dichloroacethane). From 1955 till 1963 he worked in a H.F. Alkylation plant with exposure to benzene. From then onwards in a sulfurisation plant with exposure to SO₂, H₂S, H₂SO₄ and Diethanolamine. During his treatment a splenectomy was carried out during which it was found that the liver had a normal healthy aspect.

Microscopy of the spleen disclosed a few recognisable follicles, a red pulpa with very many red cells and rather large mononuclear ones, little cytoplasm and kidney-bean like nuclei with a clumped chromatin structure. There were also many of these cells in the sinusoids. During his illness the liver was enlarged, but never more than a few fingers. In both axillae glands were enlarged and increased in number.

Biopsy showed a similar structure as the spleen.

Puncture of bone marrow disclosed extremely tough bone structure and very little marrow with only a few cells. Thrombocytes during the observation which lasted from 11 July 1968 till his death on 21 February 1972 varied between 70,000 and 153,000. Alkaline phosphatase was sometimes somewhat raised, O.T.'s and P.T.'s were always found to be normal. We do not think there is a connection with his work in the P.V.C. plant, nor does the Dutch Inspectorate of factories.

* Started work in 1949 in the P.V.C. plant, before that in the H.F. plant.

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Since mid 1972 a time weighted T.B.V. of 50 ppm is adhered to. Before that time A.C.G.I.H. advise of 200 ppm was the guiding figure. Levels are constantly being checked by spot sampling (G.L.C. analysis) and cumulative 30 minute sampling, since '72. Since January 1974 leak detectors are being used, based on the flame-ionization cell principle.

A system of fixed sampling on strategic points will be installed in September.

Apart from this, 8 hrs personal sampling got under way a fortnight ago. Results of a few early ones are disclosed in the appendices.

As for periodical examinations. Ever since 1953 there have been performed as a once a year routine. From the beginning these included chest X-ray, urine. Albumen, Reduction, Sediment, Blood, white cells, red cells, Hb, differential counts and sedimentation rate, a work history and physical examination. In 1968 a serum chemogram was included consisting of T.P. Ca, Chol, Glucose Urea, Uric Acid Creatinine, Total bilirubine, Alk. phosphatase, L.D.H., SGPT and SGOT. In addition X-rays of hands were taken. Since about 6 months platelets (thrombocytes) are counted, and YGT tests carried out.

A morbidity analysis over the years 1966 - 1973 (incl.) was carried out, matching the PVC group of workers with a comparable one on the refinery side. It includes following I.C.D. codes:

- 140 - 174,9 malignant growth of respiratory and digestive tracts, skin, tissues and bones.
- 460 - 519,9 diseases of the respiratory tract.
- 570 - 577,9 diseases of liver, gall bladder and pancreas.
- 580 - 593,9 diseases of urinary tract.

Matching includes following qualities.

age (5 year groups), nationality, sex, number of years working in Pernis works (5 year groups), shift or day duty, collective contract or not, marital status. For each person working a whole year in PVC/VC plants, a correlated one on the refinery side was selected. Those for whom no "control person" was found, were left out.

The findings are shown in figure 3.

Serum chemograms were compared with same control group of persons dividing the available computer data in three groups according to the year of examination. From previous exercises we know the standard deviations of the various parameters for the Pernis population as a whole. These were used to test for significant differences.

Following parameters were found to be different.

1972 fig. 5	1973 fig. 6	1974 fig. 7
Ca++	Ca++	
Uric Acid	Uric acid	Uric acid
	creatinine	V.C. lower than control
	Alk. fosf.	V.C. lower than control
	SGPT	
	SGOT	

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Only uric. acid is significantly higher in all 3 years, Ca^{++} in the years 1972 and 1973.

The age distribution is shown in figure 4. All values in Table 2. Undoubtedly more information is required covering a larger span of years.

To conclude I would like to mention that together with the Dutch Inspectorate of Factories a task force has been formed which will collect data covering work history, personal and family history, physical examination and laboratory findings as mentioned above covering a group of some 550 workers in the Netherlands.

History covers such items as Raynaud disease, alcoholism, hobbies and spare time activities, fertility, sterility, still birth, abortion, feeding habits and the like.

For those interested I brought a few copies in Dutch.

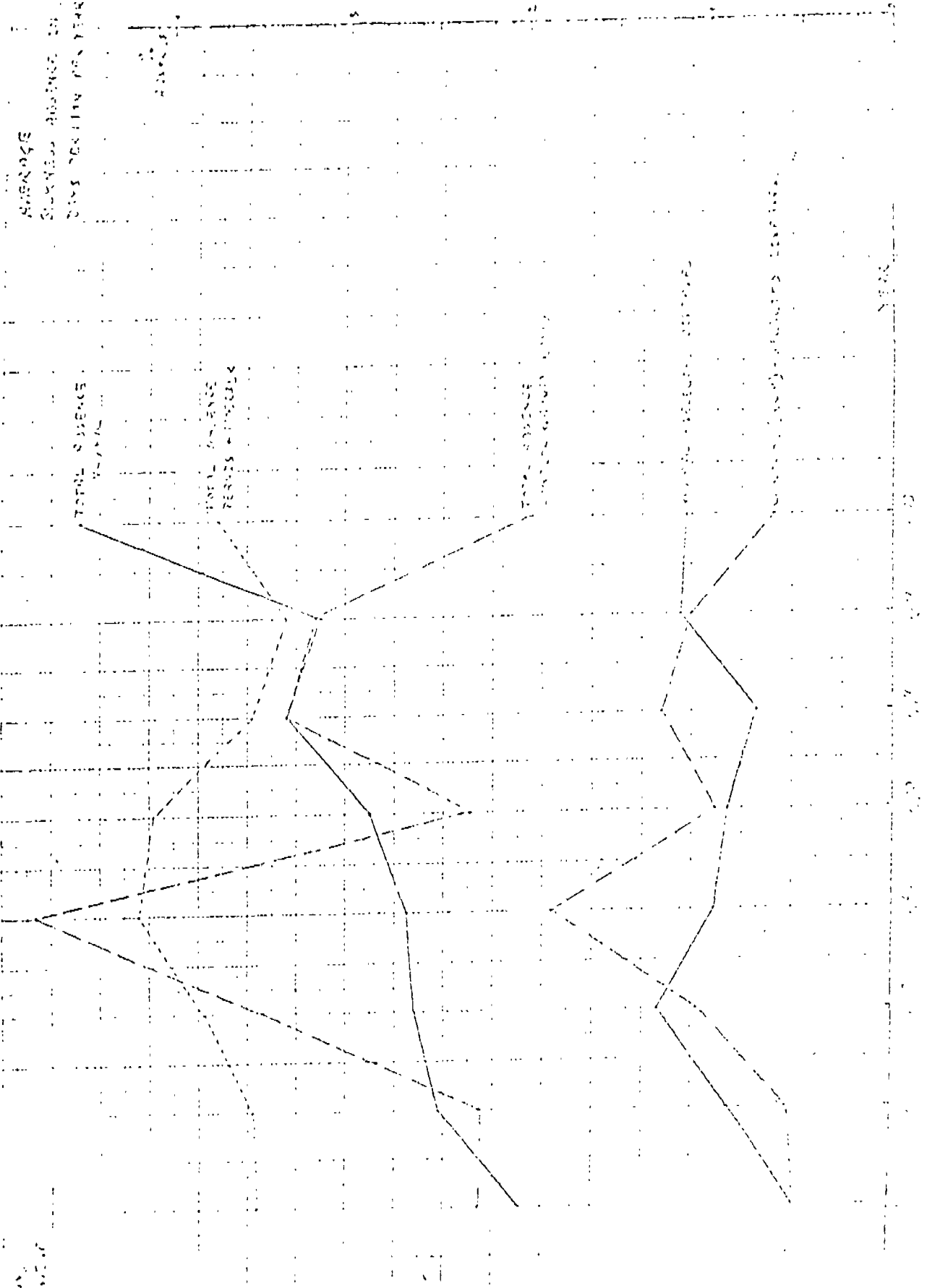
	SELECTED DISASTERS		ALL DISASTERS (incl RESIDUALS)		
	VC/PVC	RCD	VC/PVC	RCD	PERMS - INTEGRAL
1966	1.92	1.92	7.46	8.27	12.8
1967	3.24	2.09	9.10	9.26	12.3
1968	4.60	3.37	9.60	12.7	13.9
1969	3.53	6.80	9.75	17.3	15.2
1970	3.29	3.53	10.50	12.45	14.9
1971	2.71	4.60	12.2	12.2	12.9
1972	4.22	3.99	11.5	11.6	12.2
1973	4.00	2.34	16.4	7.2	12.6
AVERAGE	3.46	3.64			
ST. DEV.	.834	1.61			
DIFFERENCE NOT SIGNIFICANT					

TABLE 1: AVERAGE SIGNIFICANCE OF PROG. IN DAYS FROM 1966 TO 1973.

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		CASIO DATA FOR 1973		AVERAGE VALUES FOR 1973			AVERAGE VALUES FOR 1973			AVERAGE VALUES FOR 1974		
		AVERAGE	ST. DEV.	CONTROL	VPVC	DIFF.	CONTROL	VPVC	DIFF.	CONTROL	VPVC	DIFF.
Total protein	gms	73.95	3.93	74.45	72.25	0.50	73.10	73.97	0.13	72.15	73.32	0.37
Ca ⁺⁺	mmol/L	2.415	0.104	2.413	2.391	0.043	2.377	2.423	0.046	2.453	2.456	0.003
Chol.	"	5.036	1.030	5.053	5.786	-0.273	5.640	5.553	-0.001	5.433	5.753	-0.124
Gluc.	"	5.55	1.23	5.53	5.35	-0.13	5.73	6.15	0.12	5.52	5.34	-0.42
Urea	"	5.35	1.23	5.10	5.46	0.22	5.37	5.12	-0.25	5.02	4.80	-0.14
BUN	"	5.374	0.0145	5.372	5.407	0.005	5.372	5.372	0.000	5.372	5.372	0.000
Urea	mmol/L	10.2	16.7	11.3	16.5	3.1	10.3	12.0	-1.7	10.3	13.3	-3.0
T. BUN	"	3.2	4.5	3.4	3.6	1.2	6.9	6.5	-0.15	6.4	7.3	0.9
BUN	mmol/L	6.4	13.4	6.3	6.7	0.3	6.0	5.6	-0.4	5.3	6.1	1.5
Urea	"	16.5	27.4	15.9	15.4	0.5	15.1	15.2	0.1	15.3	15.5	-0.2
Urea	"	21.9	15.1	22.0	22.3	0.3	17.6	26.7	9.1	20.1	21.3	1.2
Urea	"	43.3	12.9	42.2	41.0	1.2	41.8	45.0	3.2	42.2	42.5	0.3
Pro	mmol/L	4.705	0.353	4.576	4.57	0.011	4.703	4.706	0.003	4.576	4.576	0.000
Pro	mmol/L	5.76	0.59	3.80	3.85	0.05	5.14	5.18	0.04	3.76	3.72	0.04
Urea	mmol/L	7.27	2.37	7.27	7.10	-0.17	7.23	5.13	-2.10	7.27	7.27	0.00
Urea	mmol/L	4.5	4.5	3.52	4.41	0.46	5.41	4.26	-1.15	4.57	5.27	0.70
Urea	mmol/L	34.9	4.5				34.3	32.1	-2.2	32.5	30.4	-2.1
Urea	mmol/L	44.0	2.0				44.4	44.6	0.2	45.9	46.0	0.1

*) Control as for 1974 are not comparable with previous values because of change in equipment.

Underlined figures are statistically significant at 95% (underline) or 99% (double line)

REC. DESIGNATION OF ... GROUP
AND ... GROUP AT JAN. 1974.

10/7/74

GROUP (REC) GROUP.

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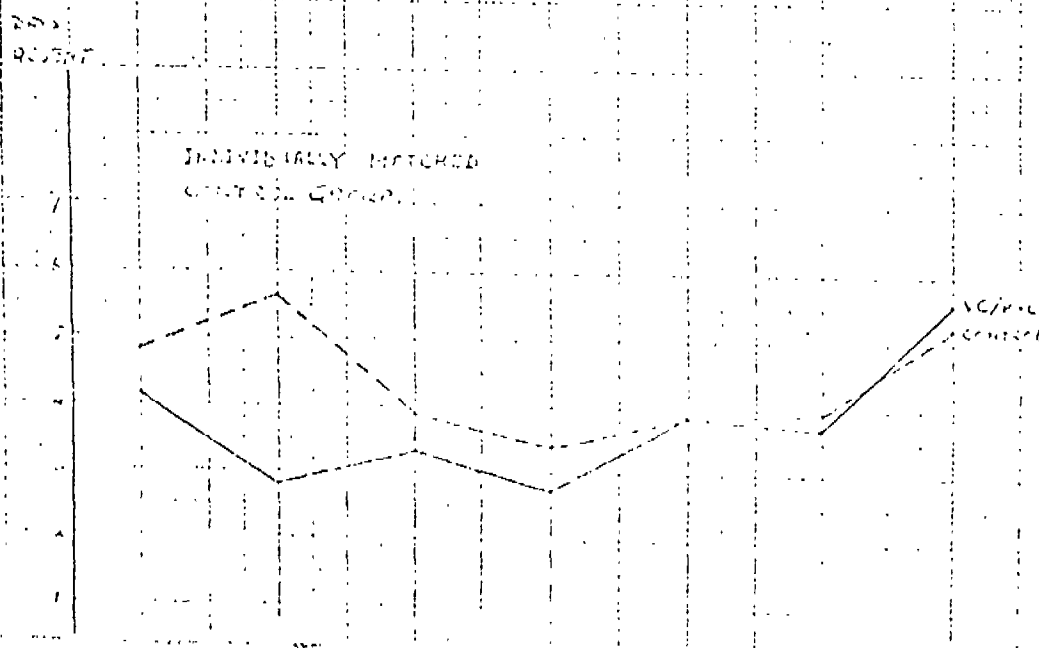
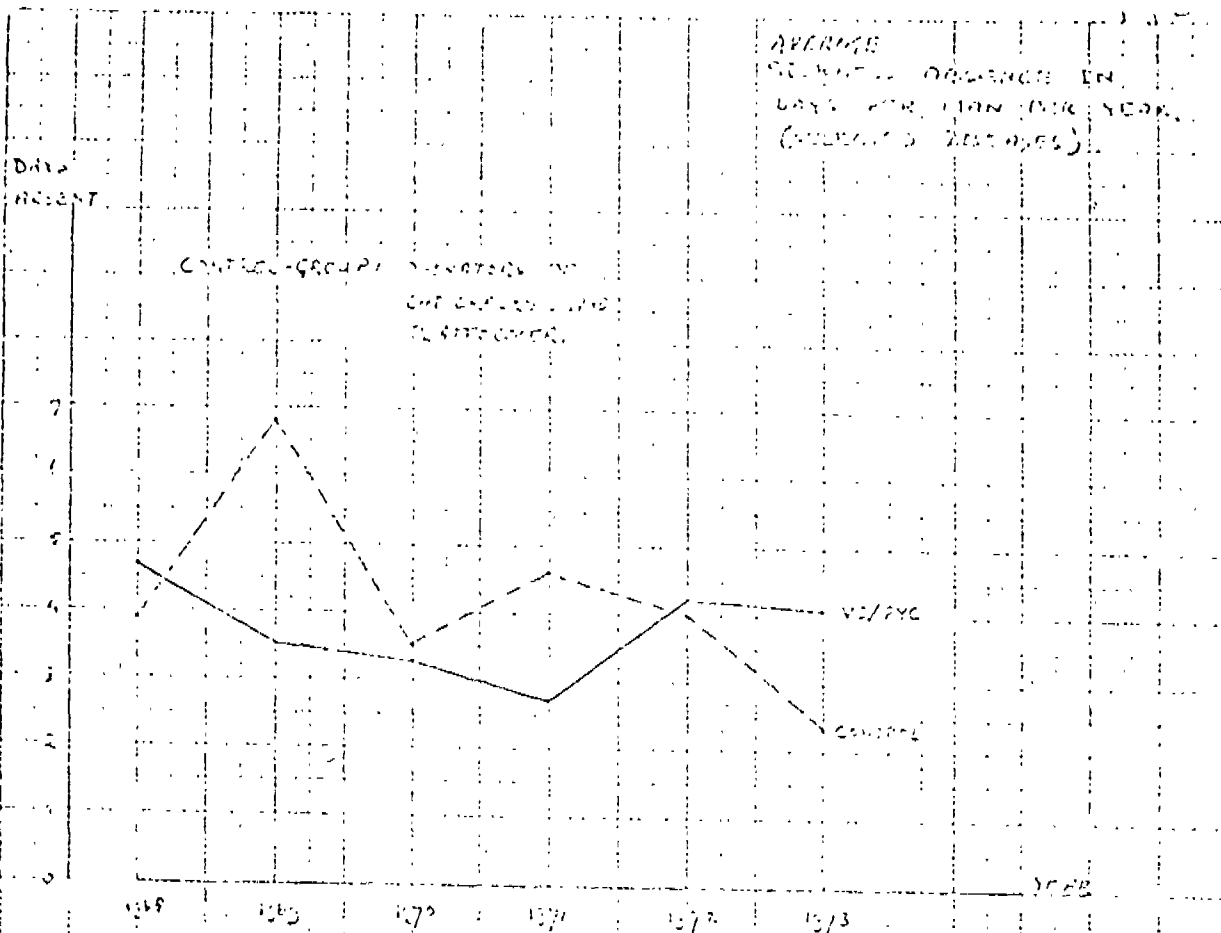
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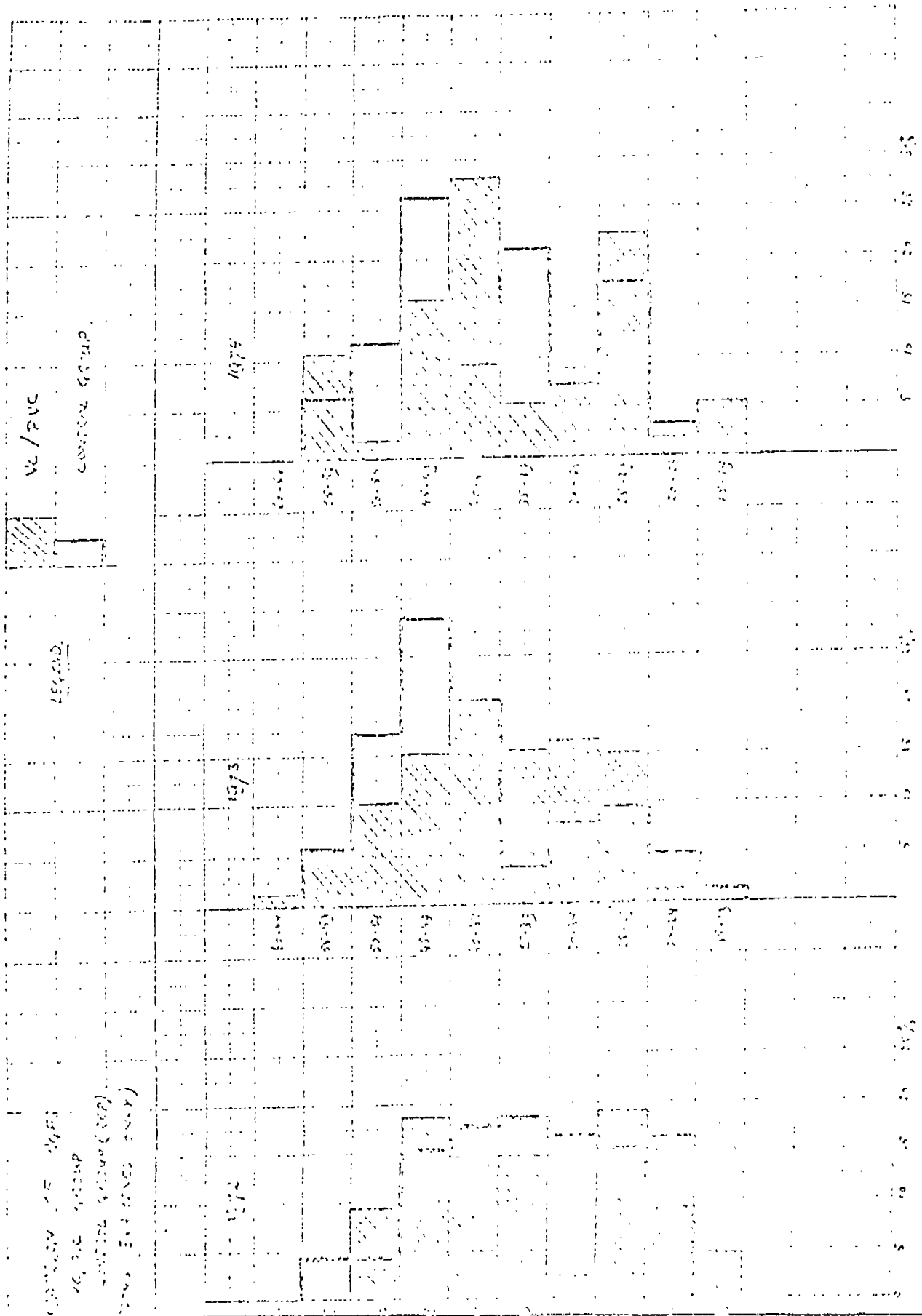
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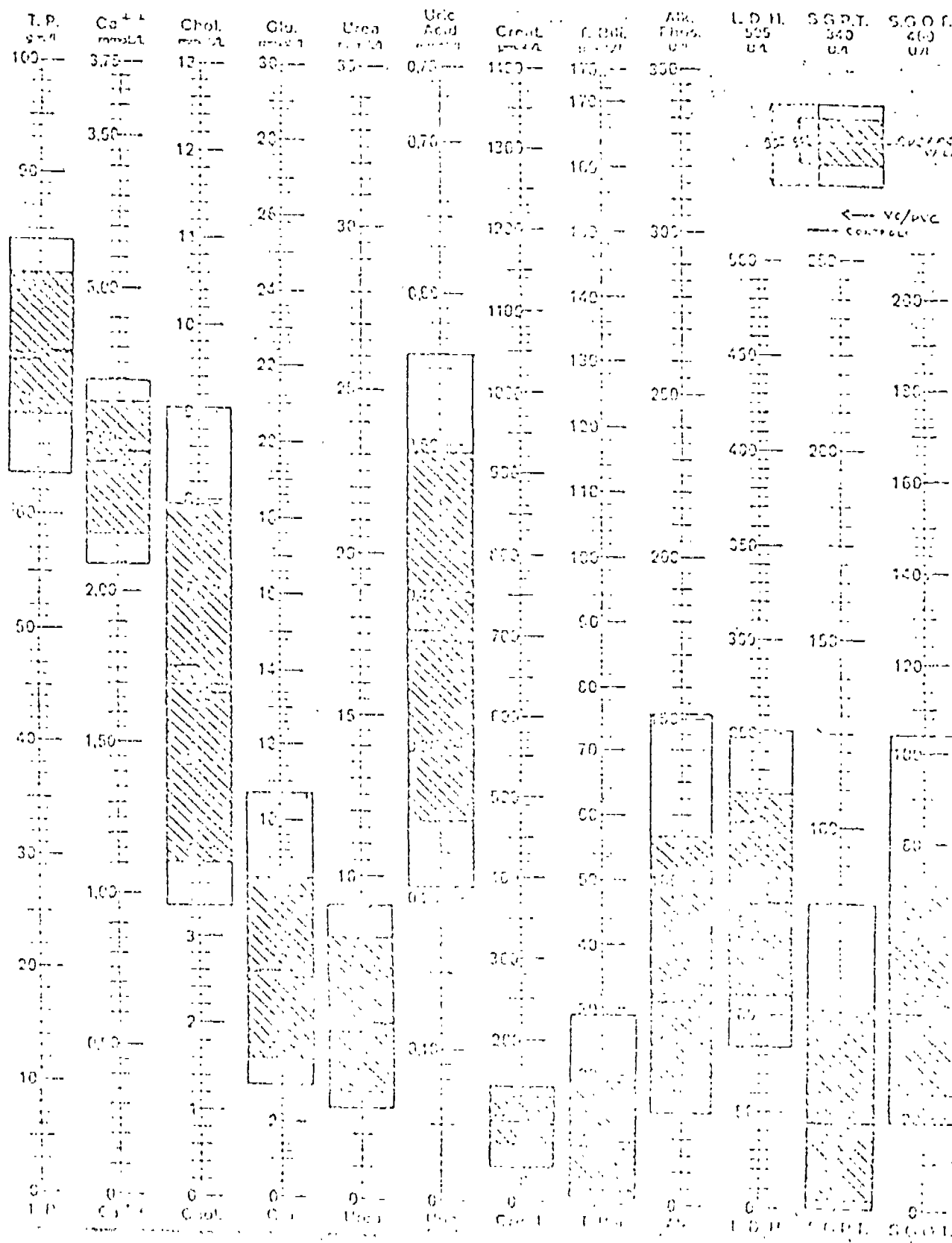


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JOHNSON
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"BASIS" OBSERVATION 1977



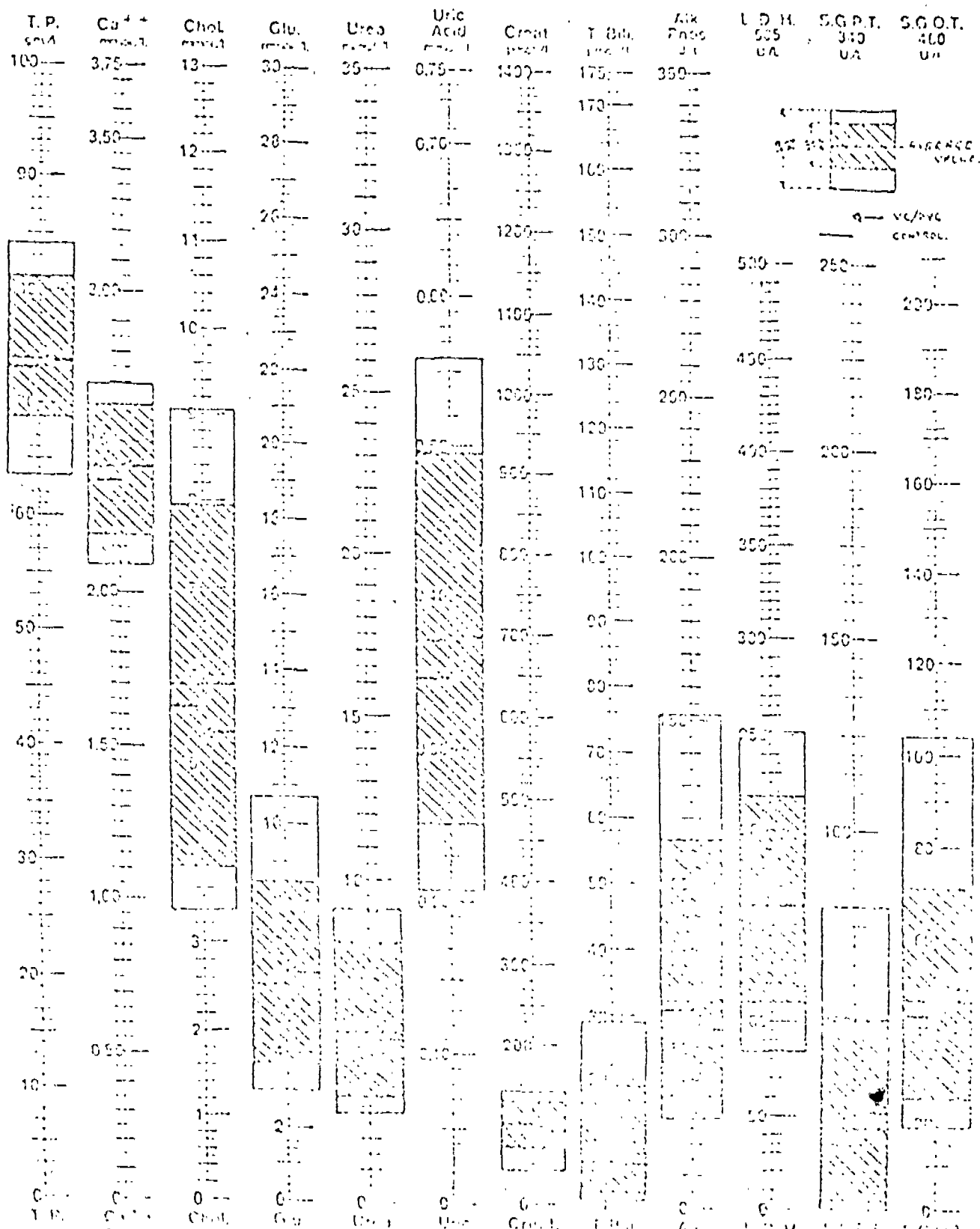
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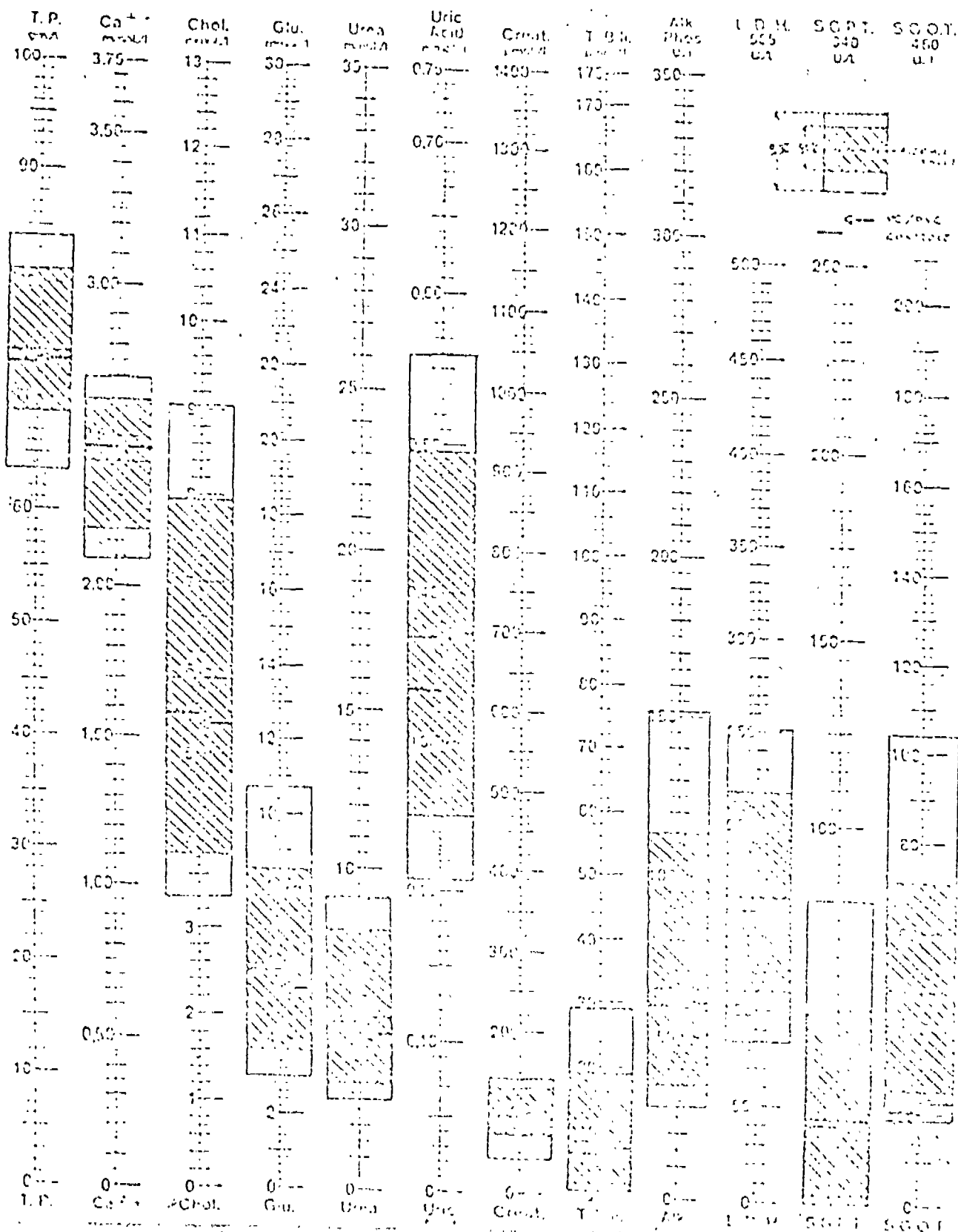


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