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The
PHILIPPINE GEOGRAPHICAL JOURNAL

VOL. XVI OCTOBER-NOVEMBER-DECEMBER, 1972 NUMBER 4

THE 22ND INTERNATIONAL GEOGRAPHICAL CONGRESS

by

DOMINADOR Z. ROSELL[1]

The first International Geographical Congress was held in Belgium in 1871. Congresses have taken place on the average of four-year interval during the hundred-year period, most of them in Europe. Two Congresses were held in Washington, D.C. one in Cairo, and another in Rio de Janeiro. The most recent ones were in Stockholm in 1960, in London in 1964, in New Delhi in 1968 and this year in Montreal, Canada, August 10-17, 1972.

In order to keep the subject of geography alive among geographers during the four-year interval between congresses, the International Geographical Union was founded in 1922 to further international cooperation in the field of geography. This year's congress in Canada was considered the first scientific congress in geography sponsored jointly by the Canadian National Committee for Geography, the Canadian Association of Geographers, the Royal Canadian Geographical Society and the Government of Canada. Geographers throughout the world were invited.

The Philippines is a member of the International Geographical Union since 1968 with the National Science Development Board as the adhering organization. As member country, the head of the delegation has a vote in scientific and policy matters in the general assembly of the Union. There were 79 countries represented during the 1972 International Geographical Congress and in the 13th General Assembly.

The number of delegates was about 2,800. Ranked according to number of delegates, Canada was first with 721, United States of America second with 514, United Kingdom third with 165, and France fourth with 112 delegates. The Philippines, like the other twelve countries, has only one delegate.

The international exhibits during the Congress was located in the University of Montreal. Of the 79 participating countries, 21 countries provided exhibits for national display and 20 countries on books and

[1] Philippine delegate to the 22nd International Geographical Congress in his capacity as Chairman, National Committee on Geographical Sciences, National Science Development Board, August 10-17, 1972, Montreal, Canada.

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journals. The Philippines participated in the exhibits on national display and on books and journal. The Philippine Board of Technical Surveys and Maps, a member agency of the National Committee on Geographical Sciences (NCGS) and represented by Commander Marcelino S. Tabin, provided the materials for national display. On books and journals, the Philippine Geographical Society, also a member agency of NCGS and represented by Prof. Dominador Z. Rosell, provided bound volumes I to XIV of the Philippine Geographical Journal. These exhibits have identified the Republic of the Philippines as having geographical materials worthy of display in the International Geographical Congress.

During the days from August 10-17, 1972 while in attendance in this Congress, a number of significant things relevant to Philippine geography have focus my inquiring mind. That geography and geographic education in this age is alive and play important role in man's activities is well expressed by the number of countries (79 countries) and 2800 delegates. The number of technical papers presented were 590 on program papers and 125 commission papers. These were all published before the congress convened.

The Philippines, in its effort to make geography alive and relevant to the country's economic development program, organized the Philippine Geographical Society in 1950 — twenty two years ago. The University of the Philippines at Diliman has to this day, the Department of Geography and Geology and also the U.P. Geographical Society composed of students taking subjects on geography and geology. The Philippine Geographical Society has sustained and maintained the publication of the "Philippine Geographical Journal" now in its 16th volume inspite of the financial handicaps. The journal has survived and continued to publish because of benevolent assistance through advertisements of Philippine Wallboard Corporation, Nasipit Lumber and Anakan Lumber Company, F. F. Cruz & Co., Inc., San Miguel Corporation, Pacific Banking Corporation, ARCA & Co., Republic Flour Mills, Industrial Textiles Manifacturing Co. of the Philippines, Inc., Certeza International Inc., Filoil, International Harvester Macleod Inc., GAMI, Marsteel, Victorias Milling Inc., M. Y. San, and Permaline, Inc., to mention a few firms.

The kind hearted people who in one way or another provided financial assistance to the life of the journal never realized that their generosities contributed largely to the geographical prestige of the Philippines. In 1968, the National Science Development Board injected into the geographical institution by supporting the Philippine membership to the International Geographical Union and creating the National Committee on Geographical Sciences with fifteen members coming from agencies of the government and private sector representing certain area of geographical knowledge.

It is hoped that through the National Science Development Board, U.P. Department of Geography and Geology, the Philippine Geographical Society, the U.P. Geographical Society, and the National Committee on Geographical Sciences, geographical education and geographical information will come back to its own position as among the scientific discipline of the world.

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PITTING POTENTIAL MEASUREMENTS BY MEANS OF THE "STATIC POTENTIAL BAND" METHOD

by

A. A. SEYS and A. A. VAN HAUTE [1]

It has already been advanced by various investigators and also by the authors that the potentiokinetic measuring techniques can lead to erroneous conclusions. This is also true for the determination of the pitting potential. To avoid the disadvantages of the potentiokinetic method, a new procedure has been worked out: the "static potential band" method.

Using the electrical resistance of a tested metal specimen, a potential drop is realized over the specimen by means of an external direct current, chosen in such a way that the pitting potential lies within the potential drop along the specimen. The absolute value of the potential is controlled by means of a potentiostat.

By applying this method, one can visually or microscopically determine the limit at which pitting does appear or not. One can also get at the same time information about the distribution of the pits in function of the potential. From this, one can draw a distribution curve by which the average number of pits per potential interval can be shown.

This method can also be used for drawing experimental "immunity-corrosion-passivation" diagrams, for research on inhibitors and for the examination of stress corrosion. This principle can also rather easily be applied to high temperature experiments.

INCONVENIENCES RELATED TO THE POTENTIOKINETIC METHOD OF PITTING POTENTIAL MEASUREMENTS

Many investigators determine the pitting potential by the potentiokinetic (2, 3, 4, 5, 6) method: the potential at which a sudden important increase of current density appears in the passive area of the polarization curve is taken as the criterion for the pitting potential. But concerning the potentiokinetic determination method, three points must be stressed:

1. Each electrode reaction liberating or taking up electrons has an influence on the polarization curve.

2. The measured current intensity is equal to the algebraic sum of the cathodic and the anodic current.

3. The measurements are done on electrical systems in which no stationary equilibrium is established.

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TECHNICAL PROBLEMS

1. How to determine the polarization curve with the adequate polarization rate? Usually the potentiokinetic method gives pitting potentials which are too high(2). Also the reproducibility depends on the polarization rate(1). Some investigators suggest the step-by-step potentiostatic(7) method instead of the potentiokinetic method.

2. How to find an adequate mounting system for the working electrode? It is very difficult to avoid interference caused by crevice corrosion. Mechanical ways of embedding are not satisfactory at all. The best results are obtained by embedding in a thermo-hardening resin(1).

By giving the necessary attention to these different problems, one might be able to use successfully the potentiokinetic method for the determination of the pitting potential. Nevertheless, there still remain some inconveniences:

1. When using a polarization rate, it really does take a long time to do the experiment. However, it even takes a long time when using the potentiostatic step-by-step method(7).

2. The above mentioned criterion for the determination of the pitting potential can not be used in environments with a strong oxido-reducing system.

3. As to the phenomenon of pitting corrosion, the polarization curve gives little more information than the pitting potential.

4. It still remains difficult to avoid crevice corrosion.

"STATIC POTENTIAL BAND" METHOD

Conception and principles. — In spite of the good results which can be obtained by means of the potentiokinetic and the potentiostatic methods, another pitting corrosion determination was developed to overcome the mentioned disadvantages.

The following principles for a new method were put forward:

1. The determination of the pitting potential must be done in a potentiostatic way.

2. The observation of pits and not the increase of current intensity must be taken as a criterion for determination of pitting corrosion.

3. The pitting corrosion behavior of the metal for different potentials must be determined at the same time.

A range of different potentials on one same sample can be obtained by causing a potential drop over the sample by means of an external direct current.

$$\Delta E = I \cdot \rho \cdot \frac{L}{S} \qquad (1)$$

ΔE potential drop (Volt)
I current intensity (Ampère)
ρ specific resistance (Ohm.cm)
L length of conductor (cm)
S section of conductor (cm^2).

The required direct current which is necessary to get a certain drop of potential is inversely proportional to the length and proportional to the section of the sample. Because of Joule-effects, to save expense in the constant direct current source, and for more accurate observation of the corrosion phenomena, it is best to take a sample of considerable length with a rather small diameter.

For the electrochemical measurements of corrosion it is necessary to know precisely the values of the range of potentials, with regard to a certain reference-potential. By means of a potentiostat, one end of the working electrode (wire) (end 1 — Fig. I) is adjusted to a known potential E_r, with regard to the reference-potential. The potential of the different parts of the wire, at a distance X from that of potential E_r can be calculated from the formula.

$$E_{(x)} = E_r + \frac{I \varrho x}{S} \qquad (2)$$

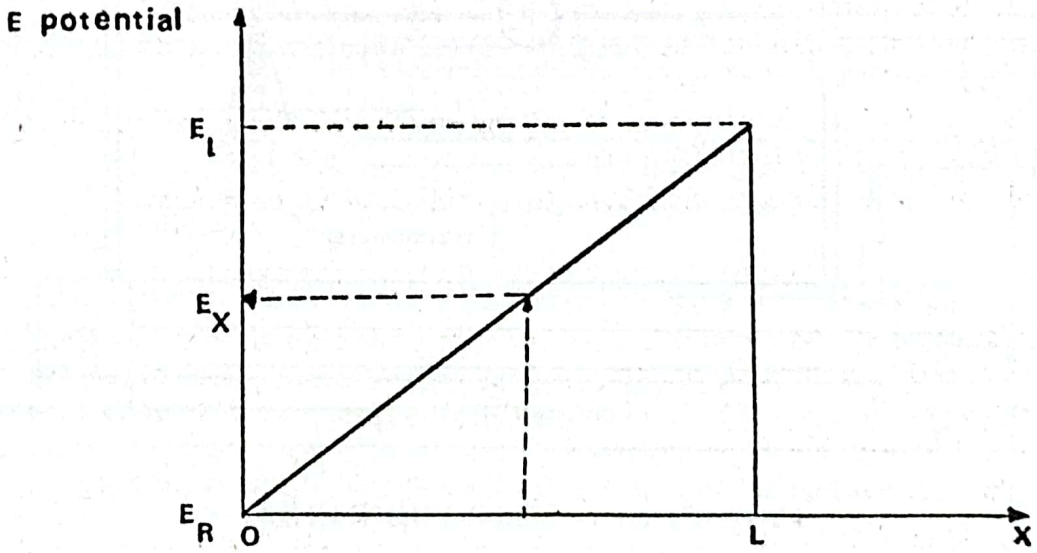

FIGURE I — VARIATION OF THE POTENTIAL ALONG THE METAL BAND

Thus a metal sample in a conventional three electrode cell which is under electric tension as above has not just one constant potential but a whole range of static constant potentials which are well determined; in other words a potential band: hence the name of the "static potential band" method.

THE METHOD OF DETERMINATION OF THE PITTING POTENTIAL

The embedding and mounting system, which was used by the authors for the determination of the pitting potential of stainless steel in a basic chloride environment, is represented in Fig. II. In a corrosion cell, which is a glass tube, a stainless working electrode is mounted in the form of a stretched wire (length 1 m) together with the reference electrode and

two Pt wires as counter electrodes; the latter are stretched parallel to the working electrode so that an even distribution of the current along the length is obtained. The glass tube is closed at both ends by rubber stoppers through which the working electrode passes. To avoid crevice corrosion the point of passage of the wire through the rubber stoppers inside the cell is covered with a thermo-hardening resin (Scandiplast). A small circulation pump (whose parts which are in contact with the electrolyte are made of P.T.F.E.) recycles the electrolyte with a regulable speed through a degassing system (air, O_2, N_2).

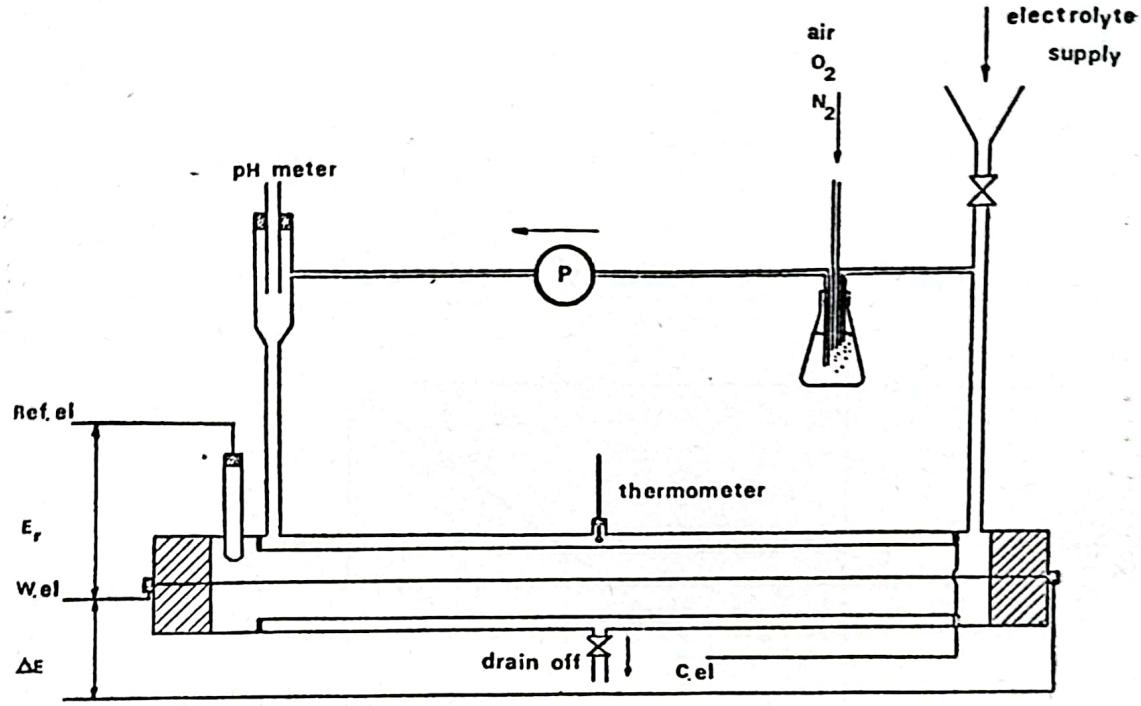

FIGURE II — CORROSION CELL

The electrical section of the apparatus is represented in Fig. III. As has been explained above, one end (1) of the working electrode is adjusted to a known potential with regard to the reference electrode, by means of a potentiostat (TACUSSEL). A d.c. voltage source (the authors used a potentiostat connected as constant source of current) sends a constant direct current through the working electrode. The two voltmeters V1 and V2 permit to control the system. The potential increases regularly over the working electrode from E_r at (1) to $(E_r + \Delta E)$ at (2), according to the function $(E_x = E_r + \frac{\Delta E \cdot x}{L})$.

As one can see, there are two circuits; in one circuit, determined by the potentiostat, the current can be neglected ($\simeq$uA) with regard to the other which is obtained from the d.c. voltage source ($\simeq$A). The currents are measured by the ampere meters A1 and A2.

For the determination of the pitting potential, a potential drop ΔE is chosen in such a way that the pitting potential lies within the potential drop along the wire. On the wire two areas can be perceived after the test: an area affected by pitting corrosion and an unaffected area. The potential of the transitional region corresponds to the pitting potential.

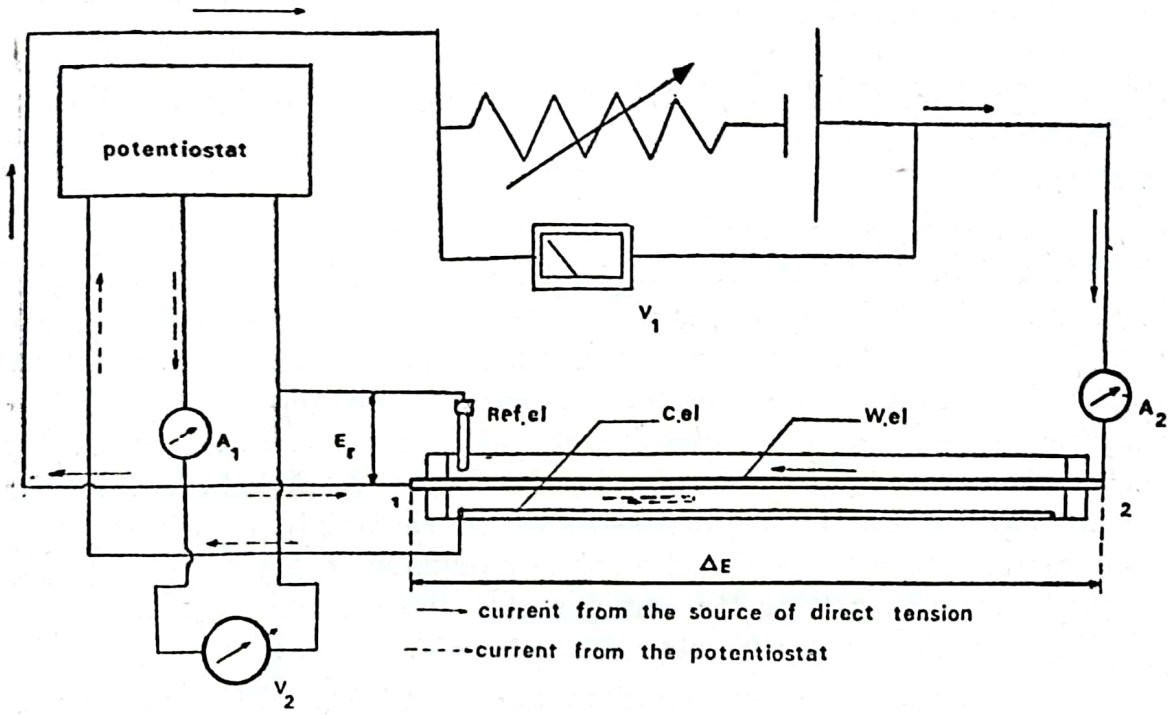

FIGURE III — ELECTRIC SCHEME OF THE CORROSION CELL

A problem that arose especially during the first tests, was the determination of the exact point from which the wire is affected by pitting corrosion. As pitting corrosion causes small scattered local pits, it is sometimes difficult to find them, and therefore difficult to determine exactly the pitting potential.

VARIOUS METHODS USED IN THE DETERMINATION OF PITTING POTENTIAL

1. Examination with the naked eye (very good when products of corrosion precipitate e.g. in a basic environment).
2. Scanning the wire with a sharp fingernail.
3. Visual examination of the wire after immersion in a $K_4Fe(CN)_6$ solution which stains the corroded places blue.
4. Examination with a common microscope or a stereo-microscope.

The best results were obtained with the microscopic method using a specially constructed holder.

EXPERIMENTAL RESULTS

Reproducibility of the method. — Before this measuring technique can be used for the study on pitting corrosion, the question arises: what is its reproducibility?

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From a preliminary study it appeared that if one wants to obtain a reproducibility of ±10mV, one has to take closely controlled samples.

The reproducibility was examined by using stainless steel AISI 304 wire with the following composition:

C	Mn	Si	P	S	Ni	Cr	Mo	Cu	Co	Nb	Ti	Fe
0,068	1,24	0,38	0,025	0,014	8,92	17,62	0,06	0,06	0,18	0,01	0,01	balance

S. A. Henricot, Court St. Etienne, Belgium, very kindly supplied us with these samples, in an annealed form (1050°C, 15', quenched in water).

The pitting potential was measured on a working electrode of 1 m length and 0.9 mm diameter, at 22°C; the test was carried out over 3 hours. The preliminary steps were: cleaning of the wire in 1 N H_2SO_4 for 5 min., degreasing in acetone, mounting of the wire in the tubular cell and covering of the ends with a thermo-hardening resin, adjusting of the potentiostat to a potential of —455 mV (N.H.E.), filling the cell with an alkaline solution of 0.1 N $KHCO_3$ + 0.1 M KCl and making of the electric connections, degassing of the electrolyte with pure nitrogen for one hour while the electrolyte circulated in the tube at a rate of 78.7 cm/min., getting the end (1) at +400 mV and realizing a potential-drop ΔE over the wire of +600 mV.

Five samples were examined in this way. The pitting potentials, determined microscopically are: 817, 805, 803, 821 and 814 mV. These figures give a spread of 18 mV and an average value of 812 mV.

From these experiments can be concluded that the reproducibility of the method is good and surely as good as the one of the potentiokinetic method. However, the pitting potential is determined in a potentiostatic way.

Comparison between the "static potential band" method and the potentiokinetic method.—Logically one expects that the pitting potential determined by the potential band method will be more negative than the one obtained by the usual potentiokinetic method. To affirm this, a series of tests was carried out with the same type of stainless steel which was used in a discussion under the heading "Reproducibility of the method." The tests were carried out in a potentio-kinetic way analogous to the said reproducibility method, except for the following conditions:

— dimensions of the electrode were: length 10 cm., diameter 0.9. mm
— the test was carried out in a conventional cell and the end of the electrode was embedded in resin to avoid edge effect
— the starting potential for the determination of the "potential-current intensity" curve was 455 mV
— the polarization rates were 500, 250, 166 and 41.6 mV/h.

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Each test was carried out twice. For the static potential band method, the average figures under sa.d heading were taken. The results are summarized in the following table:

Polarization rate mV/h	Pitting potential mV
500	922, 935,
250	890, 895,
166	892, 880,
41.6	858, 870,
Static	814

These results are plotted in Fig. IV. It is seen that the pitting potential is more positive when measured in a kinetic way than when determined in a static way. There is a great difference (50 mV) between the pitting potential obtained statically and the pitting potential obtained with a very low polarization rate 41.6 mV/h.

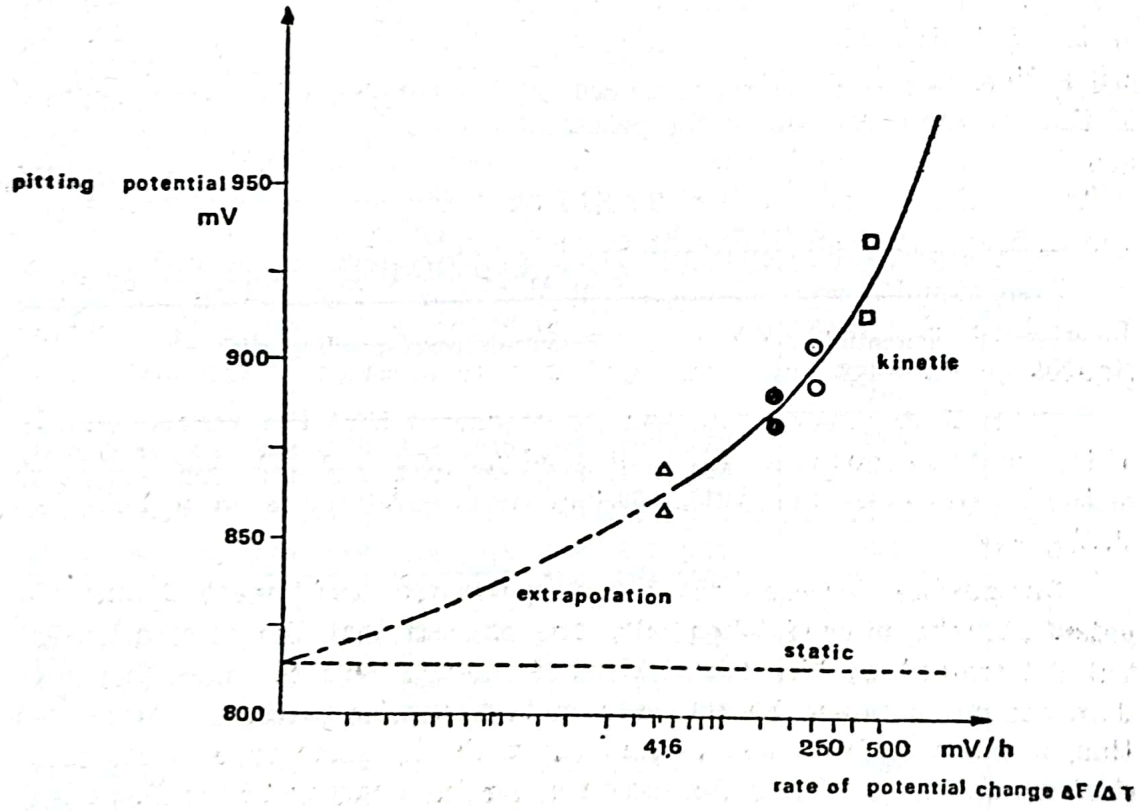

FIGURE IV — COMPARISON STATIC METHOD VS. KINETIC METHOD

APPLICATIONS OF THE METHOD

Spread of the measured pitting potential of a commercial type of stainless steel.—A problem which often arises is the following: what, for practical purposes, is the use of a quantity measured under very well defined conditions in a laboratory? What is for example the pitting potential of a type of stainless steel in its delivery-conditions (not annealed or polished)? Is it a constant or is there a spread in values

measured for the different samples? A commercial type of stainless steel AISI 304 (Uddeholm Aktiebolaget) with the following composition

Cr	Ni	C	Si	Mn	S	P	Fe
18,37	10,18	0,05	0,043	0,83	0,012	0,017	balance

was examined in the cell of Fig. II after degreasing in acetone, mounting of the working-electrode and covering of the ends with thermohardening resin, filling the cell with a solution of 0.1 M $KHCO_3$ + 0.1 M KCI; the solution was saturated with oxygen for one hour. The dimensions of the electrode were 1000 mm in length, 0.6 mm in diameter; the reference-potential was adjusted to + 650 mV and a potential drop of 300 mV was realized over the working electrode; the temperature was 22°C.

With the described cell one determines a pitting potential by realizing a substantial potential drop over the wire; in this way it is also possible to examine the whole potential range with regard to pitting corrosion, a thing which is not possible with the more widely used electrochemical methods. During the study of the spread of the measured pitting potential, the distribution of pits at potentials higher than the pitting potential has also been examined. The results obtained are summarized in Table 1: the spots where pitting corrosion appeared, are indicated by their corresponding potential.

TABLE 1

THE SPOTS WHERE PITTING CORROSION APPEARED

Test No.	Potential Pitting mV	Potentials corresponding with pits mV
1	741	755, 799, 806, 810, 819, 826, 832, 835, 856, 861, 863, 871, 885, 896, 908, 913, 920, 922, 927, 927, 930, 933.
2	745	776, 788, 805, 810, 815, 832, 836, 837, 858, 862, 868, 893, 901, 901, 909, 917, 921.
3	721	803, 813, 814, 822, 825, 831, 836, 839, 843, 843, 846, 851, 852, 853, 858, 865, 867, 868, 870, 871, 873, 876, 881, 889, 893, 894, 897, 900, 903, 908, 913, 915, 918, 920, 926, 926, 927, 935, 935.
4	782	799, 825, 859, 881, 885, 888, 889, 892, 894, 898, 899, 900, 901, 905, 910, 911, 912, 919, 921, 923, 926, 931, 932, 934, 935.
5	722	733, 771, 773, 789, 796, 799, 809, 817, 820, 822, 826, 846, 847, 856, 862, 863, 864, 865, 866, 868, 871, 873, 875, 877, 878, 879, 881, 881, 882, 883, 888, 889, 890, 892, 894, 897, 898, 900, 902, 903, 905, 907, 912, 914, 916, 917, 923, 928, 932, 934, 935.
6	759	773, 778, 786, 791, 799, 805, 818, 822, 827, 828, 830, 840, 844, 846, 852, 854, 856, 859, 865, 866, 872, 874, 876, 882, 883, 888, 889, 895, 897, 901, 912, 912, 928, 929, 930, 932.

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For these six tests, the pitting potentials have a spread of 61 mV; the average value amounts to 745 mV, with maximal deviations of + 37 and — 24 mV.

From the third column, the following can be concluded:

1. The number of pits in the examined potential area differs from one electrode sample to another,
2. The pitting potential sometimes lies rather far from the potential corresponding to the second corrosion pit, and
3. The difference in potential between two other pits can also differ strongly.

These three observations certainly argue in favor of the idea that the initiation of pitting corrosion occurs at weak defective spots in the metal or film surface.

From the potentials corresponding with the corroded spots a pit distribution curve has been drawn: Table 2 was first made which shows the number of pits per potential interval of 25 mV and the average number of pits per interval; these values are then plotted in the histogram shown in Fig. Va.

By equating the average number of pits per potential interval with the probability of corrosion in the interval, we can deduce from these results a probability curve: assuming that the probability at high potentials is 1 and that the pit density for lower potentials varies linearly

TABLE 2

SHOWING THE NUMBER OF PITS PER POTENTIAL INTERVAL

Steel AISI 304	Number of "pits" per interval of 25 mV						Average number
test no.	1	2	3	4	5	6	
potential interval							
650 — 674	0	0	0	0	0	0	0.00
675 — 699	0	0	0	0	0	0	0.00
700 — 724	0	0	1	0	1	0	0.33
725 — 749	1	1	0	0	1	0	0.50
750 — 774	1	0	0	0	2	2	0.83
775 — 799	1	1	0	2	3	4	1.83
800 — 824	3	3	4	0	4	3	2.83
825 — 849	3	3	7	1	3	6	3.83
850 — 874	5	3	11	1	9	8	6.17
875 — 899	2	1	6	8	15	7	6.50
900 — 924	4	5	7	9	10	4	6.50

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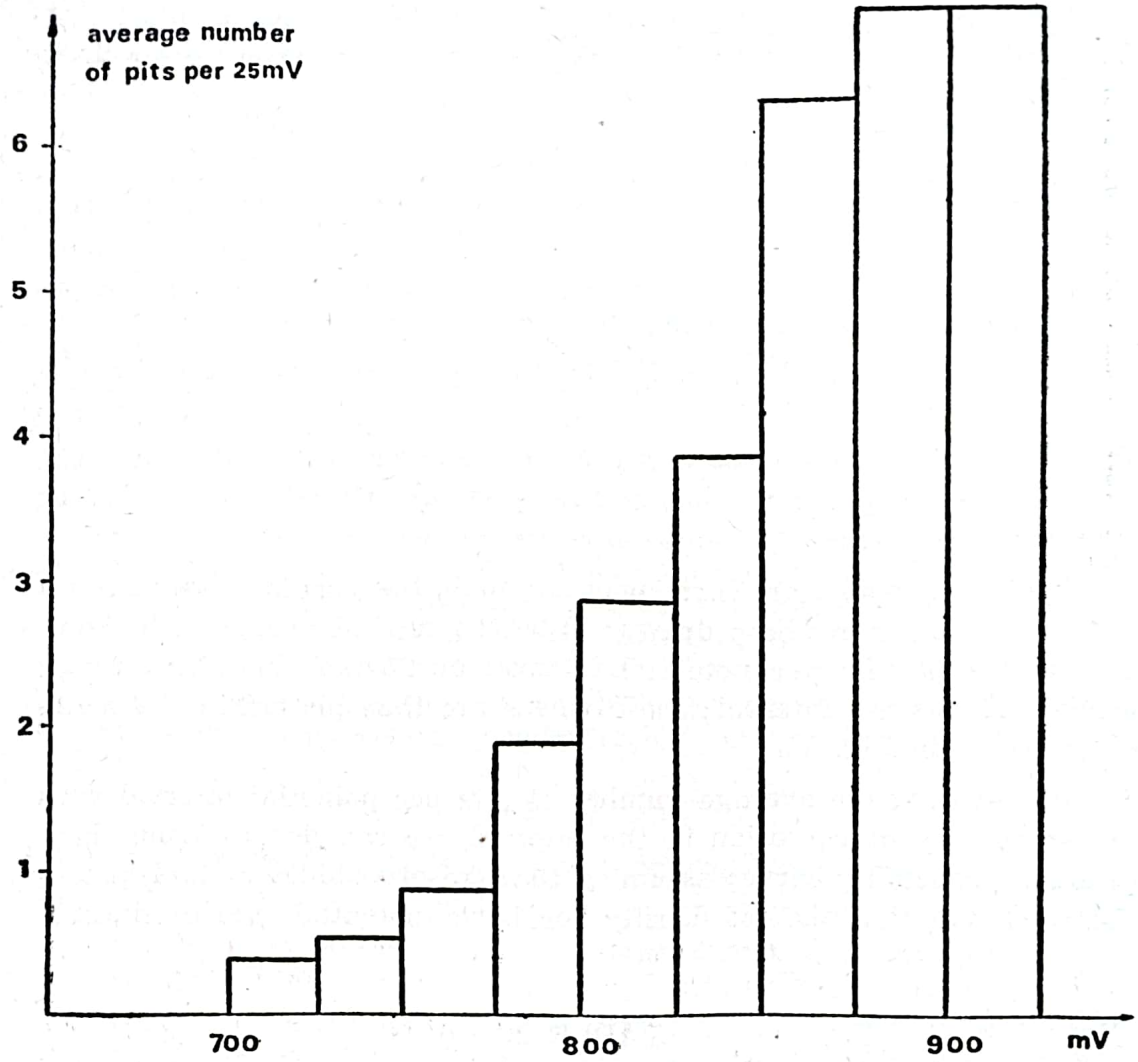

FIGURE Va — HISTOGRAM SHOWING THE AVERAGE NUMBER OF PITS PER POENTIAL INTERVAL

with the probability. The probability curve of the study of commercial stainless steel, mentioned above, is presented in Fig. Vb. From this the potential where the possibility of having pitting corrosion becomes zero can be determined: in the present study this is 675 mV. This potential has been called "critical pitting potential". At values lower than the critical pitting potential, under no circumstances can pitting corrosion occur.

The following deduction can be made from this concept of critical pitting potential: by using the cathodic protection method, the potential of the protected object has to be held under the critical pitting potential. The protection potential measured in this way will be more positive than the one described in ref. 9. That no pitting corrosion occurs under this critical potential was tested by the following experiment: an electrode was mounted in the same conditions as in the tests described under the heading "Comparison between the Static Potential Band Method and the Potentio-kinetic Method," except that the potential of end (2) was put at +675 mV, using a potential drop over the wire

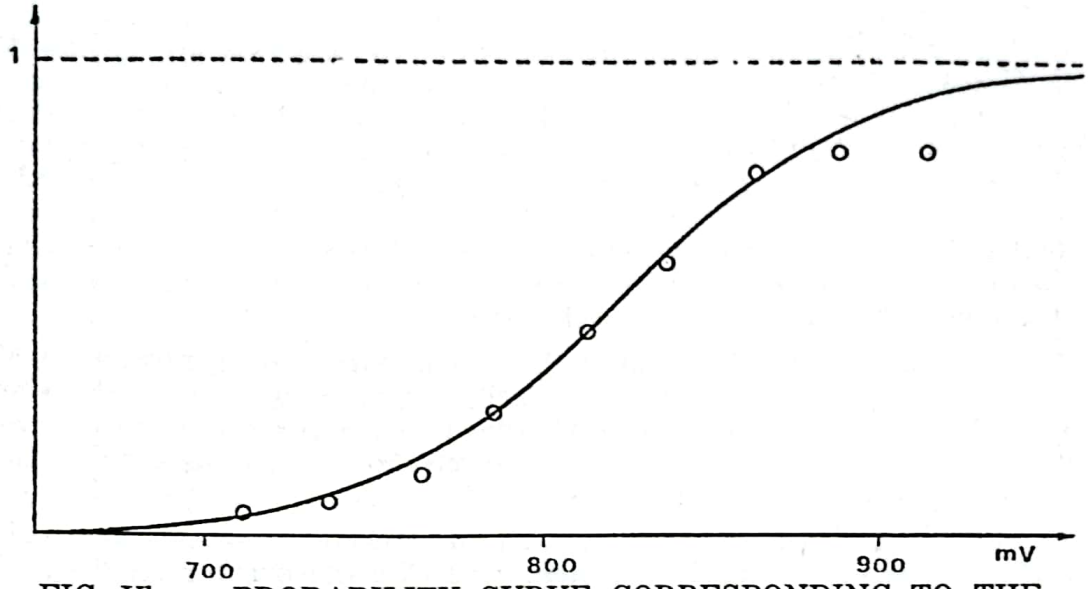

FIG. Vb — PROBABILITY CURVE CORRESPONDING TO THE HISTOGRAM OF FIG. Va.

of 400 mV. After 30 days no pitting corrosion had occurred. The appearance in the above work of a potential below which no pitting is observed is direct supporting evidence for the concept of "pitting potentials," congtrary to the findings of some investigators (10, 11).

In an analogous way the spread of the pitting potential of a commercial stainless steel AISI 302 (Uddeholm), industrially annealed and electrolytically polished, was determined. The average pitting potential over 15 tests was 944 mV, with a maximal deviation of +56 mV and —64 mV. The critical pitting potential was shown to be 880 mV.

Influence of the presence of oxygen and of electrochemical polishing. — With the static potential band method, the influence of oxygen and the influence of the electrolytical polishing on the resistance of stainless steel to pitting corrosion was checked. It was found that the presence of oxygen moves the pitting potential somewhat to higher values ($\simeq$ + 25 mV). The results also showed clearly a positive influence of the annealing and electrolytical polishing of the sample.

FINAL CONSIDERATIONS

The "static potential band" method gives a new means of determining the pitting potential in a potentiostatic and thus in an exact way.

A difficulty which one encounters with the potentiostatic step-by-step method is: how long to wait before determining the pitting potential? With tests of long duration, the measured pitting potential can move somewhat in a negative direction, because new pits are still developing. Also the pits formed at the highest potential, grow very fast, and the wire breaks quite quickly at these points.

It also happens that some corroded places, especially by the lowest potentials, stop growing. These are probably pits which repassivate. This probably corresponds with the notions introduced by Fordcham-

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mer(12) in connection with the repassivable pitting potential and the stationary pitting potential. During our tests only the pits which do not repassivate were taken into account. As duration of the test, conventionally 3 hours were taken. The static potential band method thus offers the possibility to examine a type of stainless steel in half a day: this certainly is not possible with step-by-step potentiostatic methods. Moreover, it provides information about the number of pits and their distribution. So it could be found that sometimes areas of several centimeters occurred, where no pits were visible, while in other areas several pits were found close to each other.

The specific resistance over the whole wire should remain equal and constant; also the current intensity supplied by the potentiostat (μA) itself should be small in comparison to the current intensity necessary for the potential drop. This surely is the case as long as no important pitting corrosion has occurred.

This method can only use as a working electrode specimens which are long and have a small diameter: otherwise the current required to cause the potential drop becomes too high: it is not very easy to polish such electrodes.

The "static potential band" method is probably applicable with equal success for other electrochemical corrosion studies. It seems to be a very interesting method to test the influence of certain factors on corrosion-phenomena such as chloride ions, inhibitors, preparation of metal surfaces, . . .; furthermore, it can also be used for electrochemical investigation on stress corrosion cracking and for drawing experimental "immunity-corrosion-passivation" diagrams. This principle can also be applied to high temperature experiments.

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THE RIVER THAT GOT BACK ITS PURITY

by

MARGARET VARLEY[1]

Twenty years ago the River Derwent below Derby, in the English midlands, was a dead river. The water was grey and oily, with tufts of sewage fungus floating in it. Bubbles of methane and hydrogen sulphide gases rose from the black mud of the river bottom. And the water was hot, especially in winter when darkness falls early.

Today, this same river provides drinking water for a city. It holds plenty of fish, giving sport to local angling clubs, and it is fringed with a wide variety of plants.

This transformation has cost a lot of money. But it proves that rivers anywhere can be rescued from pollution when the will exists.

BROUGHT COURT ACTION

The story began in 1951 when two fishing clubs and a riparian owner, supported by the Anglers' Cooperative Association, brought an action in England's High Court. They sought injunctions to prevent three defendants from altering the quality of the river water. And the injunctions were granted, with damages to compensate the angling clubs for loss of fishing.

The three defendants were a city corporation whose sewage disposal works was old fashioned and overloaded; a large chemical factory producing waste organic matter and hot condenser water; and a power station discharging hot cooling water. Their combined discharges, all three within a mile (1.6 kilometers) or so of each other, added up to a very high BOD (biochemical oxygen demand) in water often more than 15 degrees centrigrade warmer than the river above Derby.

The effect of this high BOD was to encourage the prolific growth of sewage fungus in the river. This used up all the oxygen in the water so that the organic matter broke down anaerobically, producing stinking black mud from which gases bubbled up.

Even if there had been enough oxygen, the fluctuations in temperature would have made the water unsuitable for most organisms.

REMEDIES CLEAR

The remedies were clearly to reduce the load of organic effluent and the amount of hot water being discharged. This meant reconstruction of the sewage disposal works, construction of cooling towers, and redesign of parts of the factory and power station. The total cost ran into millions of pounds sterling.

One problem was how to treat the effluent from the factory at the sewage disposal works so a small pilot sewage plant was run with various mixtures of domestic sewage and trade effluent.

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The "activated sludge" method was not successful. But fortunately a regime of alternate double filtration of the mixture produced high quality final effluent. So the new sewage disposal works was designed for this system of treatment.

REGULAR SURVEYS

To monitor the effects of their alterations, the city and the factory asked me to make regular surveys of the animals and plants in the river. Chemical analyses reveal conditions that exist at the moment the water samples are collected — whereas chemists test for substances that they expect to be present, so it is possible that they can overlook unexpected pollutants.

A biological survey gives a more reliable picture of the state of the river as the organisms present are those that can survive the worst conditions that occur. Fishes are less satisfactory as indicators than are river bottom fauna because fish can often swim away when conditions become unsatisfactory and return when they improve, but the invertebrate animals and the plants have to live there all the time.

The River Derwent is not easy to survey because it has a fast current with minimum flows of about 100 million gallons (455 million litres) a day and the bottom is sometimes hard clay, sometimes mud, sometimes stones and gravel. A healthy river would have different sorts of animals on these types of bottom so all have to be sampled separately.

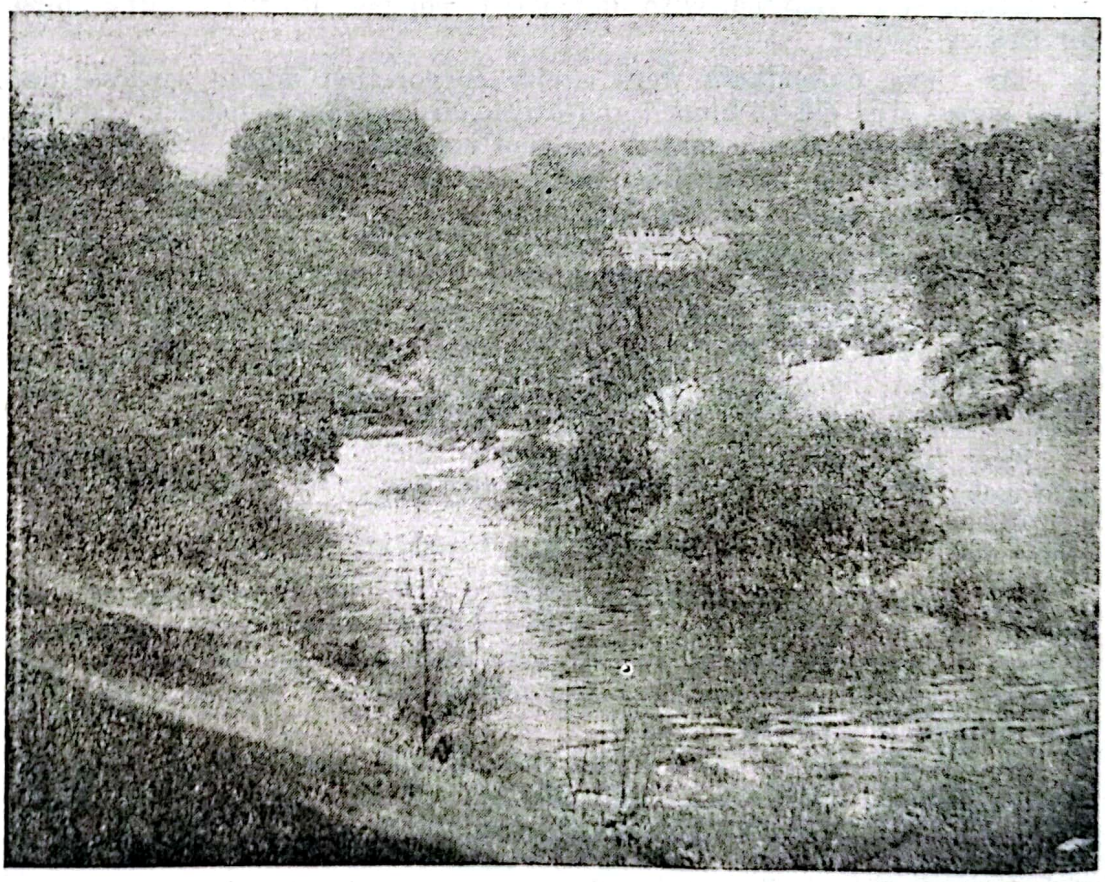

FIGURE I — THE RIVER DERWENT FLOWING THROUGH CROMFORD, IN DERBYSHIRE, ENGLAND.

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The same applies to the plants, either emerging near the banks or submerged in the water.

IMPROVEMENT SHOWN

While the sewage disposal works was being rebuilt — a period of seven years — the amount of hot water discharged was reduced by the construction of cooling towers. The organic effluents were partially treated by sedimentation.

There was still a high BOD in the water and prolific growth of sewage fungus. But sampling the river bottom deposits showed that there had been an improvement.

The mud was no longer black and stinking all the way down but much of it was now brown and full of small red worms (Tubificids). In some places there were very large number of "bloodworms" [red midge (Chironomid) larvae].

Though both these species can live where there is little dissolved oxygen, they cannot survive where there is none. They stir up the mud as they feed on the bacteria and organic matter in it — and gradually they can disperse deposits.

BEGAN TO CHANGE

Soon after the new sewage disposal works came into operation the bottom fauna began to change. There was still sewage fungus near the outfall and Tubificid worms and bloodworms in the mud — but a predatory leech (Erpobdella) became numerous, no doubt feeding on the worms and bloodworms. The water slater (Asellus) and some snails were found living in the few clumps of reeds near the banks.

A dramatic change was the appearance of fishes along the whole stretch of river. Anglers reported catching fish regularly in the two miles 3.2 kilometres) above the confluence of the Derwent with the River Trent (Fig. I). Above that, the situation was unpredictable.

Three years later slaters and leeches were the most common animals in the Derwent, both species being present in large numbers. Bloodworms were still common in places and there were several species of snails among the plants. I caught a few freshwater shrimps and a few insects such as dragonfly nymphs.

STRIKING

The most striking change in the past 10 years has been in the flora. Clumps of bur-reed and flowering rush have spread to form a fringe of emergent vegetation along most of the length of the banks.

Various pondweeds grow in the water where it is sufficiently shallow and arrowwort has appeared in places. These plants support many kinds of snails and a variety of leeches of different species that live on the snails. The predatory leech Erpobdella and the slater Asellus are still numerous but do not dominate the fauna as they did ten years ago.

Bloodworms and Tubificid worms are common only in backwaters and in very deep, muddy stretches. I have collected caddis larvae and mayfly (ephemeropteran) nymphs — animals characteristic of clean rivers.

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In fact, if I had first visited the river in 1971 I would have diagnosed it as suffering from mild organic pollution not serious enough to worry anglers who want to catch "coarse" fish such as roach and chub. Small fishes are now common all the way below the sewage outfall and it is clear that minnows and sticklebacks breed successfully, suggesting that other species do too.

PLENTY OF FISH

An accidental but serious pollution from the factory in October 1971 confirmed that the river held plenty of fish. About 10,000 large fish, averaging about half a pound (0.23 kilogrammes), were killed — mostly roach but also large numbers of chub and dace. Probably the chemical firm concerned will re-stock the river in the spring.

Altogether, the change has been dramatic. Today the River Derment below Derby is being used as a source of drinking water for the city of Nottingham! Water is pumped out of the river into a storage reservoir and later treated and distributed to the city.

So, in 20 years, a river that was heavily polluted and held no fish has been transformed. The angling clubs that sought the injunctions in 1951 have had their angling restored and the community at large has benefited because the water from the Derwent improves the condition of the polluted River Trent.

The same sort of exercise in river improvement is being attempted in other parts of the Trent area as well as in other British waters. It shows that if the community decides that clean water and recreation are worth the cost of capital investment in works and equipment by cities and industry, then dirty rivers can and do recover from pollution.

INTERNATIONAL GEOGRAPHICAL UNION REGIONAL CONFERENCE, NEW ZEALAND, 1974

The next Regional Conference is to be held in New Zealand from November 27th to December 18th 1974 under the auspices of the Royal Society of New Zealand. The theme has been designated as "New Zealand, the Pacific and its Margins" and papers with reference to this area will be invited for the following sections: Social Problems, Man Environment and Perception, Land Resources, City and Village, Economic Development, and the Teaching and Tasks of Geography.

Pre-Conference Tours will start from Auckland and Christchurch on November 27th and those following the Conference will leave after the meetings at Massey University from Palmerston North. These should terminate at Auckland and Christchurch by December 18th.

For the First Circular, write to:

Conference Secretariat
Department of Geography
Massey University
Palmerston North
New Zealand

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THE CURRENT MEAT SUPPLY IN THE PHILIPPINES

by

VALENTE VILLEGAS [1]

Meat is the "flesh or edible part of striated muscle of an animal of which there are the voluntary, involuntary and cardiac muscle". Voluntary muscle has 75 percent moisture and 25 percent dry matter. Twenty percent of the dry matter are proteins consisting principally of myosin. In the muscle are ten essential amino acids which must be taken by a growing person or animal if normal growth or life is expected. The muscle also contains carbohydrates, inorganic salts and extractives.

Men crave for meat more so with growing young persons. Meat is highly acceptable to the palate. Meat, therefore, satisfies and is highly nutritious. Preference for different kinds of meat and variety of preparation varies with different individuals.

Meat of cattle is called *beef;* of calves below one year of age, *veal;* of carabaos, *carabeef;* of swine, *pork;* of adult sheep, *mutton;* of lamb, below one year of age, *lamb meat*; and of goat, *chevon.*

MEAT PROVISIONS OF THE NATION[2]

In the FY 1970-71, based on data in provinces with meat inspection service, the total number of carabaos butchered was 73,646 head, giving 13,004,411 kgms. of dressed carcass. At the National Abattoir, 7, 912 head were slaughtered, producing 1,391,218 kilograms of dressed carabeef. In Manila, 36,247 head were butchered, giving 7,412,731 kgms. of dressed carcass. In the suburbs of Greater Manila, the number slaughtered amounted to 674 head from which the amount of dressed carabeef was 109,869 kilograms. The total number of carabaos butchered during the year amounted to 118,479 head, producing 21,918,229 dressed carcass.

In the same period, the number of cattle slaughtered in the provinces was 199,223 head, producing 29,355,509 kgms. of dressed carcass. In the National Abattoir, 14,522 head were butchered, giving 1,391,218 kgms. of dressed beef. In Manila, the number slaughtered amounted to 27,225 head, producing 5,559,206 kgms. of dressed carcass. In the suburbs of Greater Manila, the number butchered amounted to 1,762 head, the amount of dressed beef being 264,813 kgms. Altogether, the total number of cattle slaughtered in the Philippines amounted to 242,732 head, the dressed carcass amounting to 87,645,264 kgms.

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[1] NSDB Technical Consultant on Animal Science and U.P. College of Agriculture Professor Emeritus on Animal Husbandry.

[2] Data from Bureau of Animal Industry.

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Horse meat since World War II has entered the food market, a way by which undesirable horses because of viciousness, small size, and ugly conformation are turned into meat. Manila, Malabon, Rizal, and Pasay City are among the centers of horse meat production.

In the provinces, 2,104 horses were slaughtered, the dressed weight of meat from them being 246,168 kgms. At the National Abattoir, 268 horses were butchered, the yield being 24,314 kgms. of dressed carcass. In Manila, 402 horses were slaughtered from which 32,386 kgms. of dressed meat were produced. In the suburbs of Greater Manila, 242 head were slaughtered, the production of dressed meat being 28,229 kgms. The over-all data amounted to 3,016 head of horses with a production of 331,097 kgms. of dressed horse carcasses.

Sheep and goats are grouped together in this paper, but only a few sheep in relation to goats are included. The Filipinos in general are not as yet partaking mutton. Spaniards owning large tracts of agricultural land raise sheep. As a means of increasing our meat supply, our farmers, ranchers in particular, should raise sheep which are easier to produce than goats on a large scale. On the part of goats, chevon is at present popular when cooked into "caldereta."

In the provinces, 47,653 head of sheep and goats were butchered from which 524,183 kgms. of dressed mutton and chevon were obtained. In Manila, 80 head were slaughtered giving 1,023 kgms. of dressed chevon and mutton. A large number of goats are commonly butchered in individual homes which are not counted in the figures above.

IMPORTATIONS [3]

Importations of meat and meat preparations amounted to a total of ₱33,134,028.80.

Fresh (also chilled and frozen) meat is valued at ₱13,544,130.80 or 40.9 percent of both fresh and processed meat.

Fresh beef and veal are valued at ₱11,969,414.40 which is 88.6 percent of fresh, chilled, and frozen meat. Thirty-three and nine-tenths percent of fresh beef and veal came from Argentina, 27.2 percent from Australia, 24.2 percent from New Zealand and 11.6 percent from the United States. Other sources but in smaller quantities were Japan, the Federal Republic of Germany, Sweden, the Netherlands, and Hongkong.

Fresh pork amounted to ₱590,624 of which 47.9 percent came from Denmark and 47.0 percent from Sweden. Other suppliers were the United States and New Zealand.

Fresh mutton and lamb are valued at ₱481,548.80 of which 91.4 percent came from New Zealand and 8.6 percent from Australia.

Poultry meat amount to ₱48,499.20 or 3.6 percent of the total value. From the United States came dressed chickens valued at ₱460.80. Also from the United States came ducks and geese meat amounting to ₱16,440.00. The same classes of poultry were imported from Denmark valued at ₱11,550.00, and from Hongkong, amounting to ₱1,068.80. Turkey importations amounted to a total of ₱18,279.60 of which the United

[3] Data from the Bureau of the Census and Statistics.

States is credited with ₱15,987.20 and Denmark, ₱2,292.40. From Hongkong came poultry liver valued at ₱3,084.80.

Additional quantities of fresh, chilled and frozen meat were imported in 1970 valued at ₱620.80. Importation of canned meat amounted to ₱25,330,931.20.

Of canned meats, corned beef is the biggest item valued at ₱10,852,136.00, or 88.7 percent of the total importation of canned meats. Argentina is the premier supplier of corned beef, the value being ₱7,166,246.40, or 52.8 percent. France is next with a value of ₱3,619,603.20, or 20.9 percent. Australia is third with a value of ₱1,926,121.60, or 11.1 percent. Brazil is fourth with a value of ₱1,025,452.80, or 9.4 percent. Denmark is fifth with a value of ₱660,179.20, or 6.1 percent. Others sources are the United States, the Netherlands, Portuguese countries, Africa, Uruguay, New Zealand and Canada in the order named.

Of uncanned processed meats, hams and shoulders occupy top position among the imports, the value amounting to a total of ₱13,254.00. Hongkong's share of the importation amounted to ₱12,166.40; United Kingdom's, ₱806.40; Australia's, ₱204.80; and Spain's, ₱76.80.

Cured beef and veal from Hongkong amounted to ₱211.20; ducks and geese, also from Hongkong, ₱294.40; and poultry liver from the same source, ₱4,416.00.

The total value of dried, salted, smoked, and cooked meats, not canned, is ₱18,950.80. Hams and shoulders amounted to a total value of ₱13,254.40, much of which from Hongkong. Beef and veal from Hongkong amounted to ₱211.20. Ducks and geese, valued at ₱294.40 also came from Hongkong.

Sundry forms of processed meats, valued at ₱770.80 were imported, principally from Hongkong.

Sausages of different sorts, uncanned, amounted to ₱23,225.60. The principal supplier was Hongkong, from which the value of importation was ₱16,588.80. Other sources were Spain, the United States and Denmark in the order mentioned.

Importation of devilled meat (meat paste, meat spread) amounted to ₱16,985.60, 70.5 percent of which came from the United States and 29.5 percent from Hongkong.

The value of imports of consomme, soup and chowder is ₱62,658.00, 98.5 percent of which from the United States. Other sources but in smaller amounts are Hongkong and Japan.

Importation of meat extracts amounted to ₱10,553.60, almost all, or 97.5 percent from the United Kingdom.

Importation of natural sausage casings amounted to ₱69,363.20, 71.1 percent from Denmark and 28.9 percent from the United States. That of artificial sausage casings amounted to ₱1,906,457.60, 97.6 percent from the United States, 9.8 percent from Federal Republic of Germany, and small percentages from Australia and Spain.

Importation of edible offals of various kinds is valued at ₱70,367 of which 49.0 percent came from Denmark, 33.5 percent from New Zealand and 14.4 percent from Australia. Other countries exporting offals to the Philippines were Sweden and the United States.

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THE PHILIPPINE CERAMICS INDUSTRY

by

ROMEO G. CORDOBA [1]

The beginnings of the ceramics industry in the Philippines are obscure in the absence of traces and written accounts about the industry although ceramic wares believed to have been made in the years about 600 to 900 A.D. were unearthed in some Philippine grave sites. These wares however are believed to have originated from China that were brought into the country through commerce. Some claim that pottery making in the country had commenced long before the Spaniards came and others allege that it began in the early Spanish times. Regardless of the period Filipinos started making ceramic products, the development of the industry in the country is moving a very slow pace inspite of the intensified efforts and attention given to it by the government. Except for the manufacture of structural ceramic products, artware manufacture as well as pottery making are still home-based industries. Household ceramic wares are still produced in a very limited scale.

By and large, locally made ceramic products except structural ceramic products, still lack the desirable qualities found in imported items as they are easily breakable and porous if not bearing some imperfections. They are usually unglazed and others are crudely painted and/or varnished. While there are some high quality locally made artwares produced by local enthusiasts and hobbyists, the supply is so scarce that they are seldom found in the market and very expensive.

To date, no locally prepared refractories and ceramic insulators are available in the market although the manufacture of silica and alumina fire bricks from locally available raw materials were explored in the late fifties by ceramic entrepreneurs. For unknown reasons, the venture did not materialize. With the advent of refractory grade chrome ore mining, studies, and development of chrome refractories as well as ceramic electrical insulators are underway.

DEVELOPMENT OF PHILIPPINE CERAMICS

It may be pertinent and important to trace whatever progress Philippine ceramics has attained. The establishment of the Bureau of Science in 1905 paved the way for some studies on local clays for ceramic purposes. During that period, emphasis was laid on the search for clay deposits, clay analyses, and formulation and physical tests of ceramic bodies. Findings in these efforts were significant as they proved the potentials of ceramics industry in the country.

[1] Assistant Scientist, National Science Development Board, Bicutan, Taguig, Rizal.

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One of the major breakthrough in the advancement of Philippine ceramics through science and technology was realized when the then Bureau of Science created the Ceramics Section which up to now is engaged in ceramic researches and other activities geared towards more diversified utilization of indigenous clay. At almost the same time, a joint effort between the Bureau of Science and Bureau of Education ventured into the establishment and subsequently the dispersal of ceramics schools in the country. Ceramic courses were encouraged and offered in almost all vocational and trade schools in areas with great clay potentials. Now there are at least 20 schools offering ceramics courses.

SCHOOLS OFFERING CERAMICS COURSES

1. Cebu School of Arts & Trades
   Cebu City
2. Davao School of Arts & Trades
   Davao City
3. Don Honorio Ventura Memorial School of Arts and Trades
   Bacolor, Pampanga
4. Iloilo School of Arts & Trades
   Iloilo City
5. La Union School of Arts and Trades
   San Fernando, La Union
6. Zamboanga School of Arts & Trades
   Zamboanga City
7. Antique School of Arts and Trades
   Sibalon, Antique
8. Capiz School of Arts & Trades
   Roxas City
9. Ilocos Norte School of Arts & Trades
   Laoag City
10. Pangasinan School of Arts & Trades
    Lingayen, Pangasinan
11. Abellana National Vocational School
    Cebu City
12. Buruanga Vocational School
    Buruanga, Aklan
13. Lambunao Vocational Ceramics School
    Lambunao, Iloilo
14. Maripipi National Ceramics School
    Maripipi, Leyte
15. Miagao Vocational School
    Miagao, Iloilo
16. Marikina School of Arts & Trades
    Marikina, Rizal
17. E. Rodriguez Memorial & School of Arts & Trades
    Manila
18. Cagayan Valley College of Arts & Trades
    Tuguegarao, Cagayan
19. Philippine College of Arts & Trades
    Manila
20. Home Industries Division
    Bureau of Vocational Education

TABLE 1

SHOWING KAOLINITIC CLAY DEPOSITS*

Location	Chemical Analysis (%)						Reserve (Metric Tons)
	SiO_2	Al_2O_3	Fe_2O_3	CaO	MgO	LOI	
Anabo & Lemery, Iloilo	44.42	40.55	2.73	0.49	0.38	11.62	Positive — 158,450 Probable — 48,960
Sicogon Island, Iloilo	63.72	26.46	1.04	0.20	0.32	6.71	Positive — 89,000 Probable — 61,000
San Dionisio Iloilo	70.28	20.13	0.81	0.36	0.98	3.71	Positive — 13,500
Gigante Island, Iloilo	42.50	38.51	0.99	0.51	0.19	14.31	Positive — 11,000
Calamba, Laguna	46.84	34.43	1.74	0.26	0.26	13.74	Positive — 160,000
Banton Island, Cagayan	52.38	29.82	1.64	0.29	0.10	14.32	Positive — 7,500
Daclan, Bokod, Benguet	47.74	30.72	0.64	0.50	0.04	17.80	White — 11,000 Butt — 19,000
Calumpan Penin, Batangas	43.02	40.43	1.61	0.04	0.59	14.36	8,000 reported minded by Int'l Ceramics
Lepanto, Mt. Province	44.16	44.50	0.48	1.25	0.17	9.62	No tonnage estimate
Nat'l Park, Mt. Makiling, Los Baños, Laguna	52.45	32.30	1.71	0.00	0.22	12.43	White — 6,500 Mottled 30,700
Calayan Island, Cagayan	40.50	44.23	0.97	0.02	0.16	14.16	No tonnage estimate
Pansol, Los Baños, Laguna	43.54	38.90	0.62	0.44	0.45	14.42	No tonnage estimate
Osiao, Bacon, Sorsogon	52.54	33.90	0.96	0.16	0.84	12.04	No tonnage estimate
Bitin, Bay Laguna	45.98	35.30	1.44	0.42	0.36	15.82	White — 12,000 Mottled 10,200
Milagros, Masbate	55.54	31.38	1.61	0.40	0.57	10.44	No tonnage estimate
Angat, Bulacan	47.68	36.94	0.96	0.56	0.74	8.02	No tonnage estimate
Akle, Bulacan, Bulacan	78.64	15.14	0.39	—	—	2.20	23,000
Infanta, Pangasinan	42.95	41.13	0.61	2.30	0.44	13.13	No tonnage estimate
Seruma Peninsula, Cam. Sur	89.00	6.5	Less than one %			2.5	White — 1,618,939 Mottled 658,900

* Geological Survey Division, Bureau of Mines, The Availability of Clay Materials, Quartz and Feldspar in the Philippines.

GOVERNMENT ASSISTANCE TO THE CERAMICS INDUSTRY

The Ceramics Section of the Bureau of Science which is now the National Institute of Science and Technology (NIST) was further strengthened with the creation of the National Science Development Board in 1958. The ceramics research activities of this section were expanded and diversified. During the past years, the NIST Ceramics

Section has been engaged in ceramics extension service. Technical assistance is extended to all interested parties in the form of consultancy, use of facilities, training sessions, clay analyses and physical tests, project studies for the establishment of small scale ceramic production set-up, and many others. To encourage participation of all sectors and hasten the transfer of ceramics technology to the rural and individual producers, the NIST through its Ceramics Section has launched a five-year project aimed at developing and up-grading skills in ceramic production thru the use of simplified modern techniques of materials preparation, forming, drying, firing, and glazing operations. This project which is supported by the NSDB Special Science Fund envisions to establish ceramic training centers in regions with potential clay deposits. In these centers, training sessions will be conducted so local potters can acquire knowledge of modern techniques of ceramic production and they will be encouraged to engage in product diversification. The technical assistance will be made available to the community until such time the local potters can efficiently handle all phases of ceramics manufacture from clay processing to glazing and possibly marketing. The project will turn out skilled and semi-skilled manpower for the establishment of the ceramics industry in the cottage level especially in the rural areas.

TABLE 2

SHOWING FELDSPAR DEPOSITS*

Location	Kind	Reserved (Metric tons)	Remarks
Pasuquin, Ilocos Norte	Soda-lime spar w/ quartz and mica	3,800,000	Granulite
Pagudpud, Ilocos Norte	Soda-lime spar and quartz	344,000,000	Weathered quartz-diorite Fusion color — Gray
Bangui, Ilocos Norte	Soda-lime spar with mica and chlorite	No estimate	Fusion color — glossy white
Abra de Ilog, Occ. Mindoro	Soda Spar with quartz and mica	No estimate	From diorite Fusion color — Gray
Dupax, Nueva Vizcaya	Soda Spar	No estimate	From diorite Fusion color — Gray
Angat & San Ildefonso, Bulacan	Soda lime spar	500,000	Good quality after beneficiation
Tagkawayan, Quezon	Soda lime with epidote and mica	1,000	Quartz-diorite Fusion color — Gray
Sara, Iloilo	Plagioclase with potash spar and quartz	2,000	Potash — 5.35%
Porac, Pampanga	Soda spar with quartz	Unlimited reserved	Processed river sand from Porac river

* Geological Survey Division, Bureau of Mines, The Availability of Clay Materials, Quartz and Feldspar in the Philippines.

TABLE 3

SHOWING QUARTZ DEPOSITS IN ROCK FORM*

Location	Source	Reserve (Metric tons)	Remarks
Paracale-Mambusao, Cam. N.	Granodiorite — 30% by wt. SiO_2	3,000,000	Processed by grinding and floating for SiO_2 & feldspar
Burgos-Pasuquin Ilocos Norte	Intrusive in serpentinite	3,800,000 quartz and feldspar	Processed by grinding and floating for SiO_2 & feldspar
Pasaleng, Pagudpud, Ilocos N.	Quartz-diorite 20% by wt. SiO_2	200,000,000	Requires beneficiation to recover quartz and feldspar
Sagay, Negros Occidental	Silicified rock friable and granular, 95% SiO_2	Sand 224,000 Rock 747,500	Washing is necessary
Siaton, Negros Oriental	Similar to Sagay	1,000,000	Similar to Sagay
Amlan, Negros Oriental	Similar to Sagay	5,000	Washing is necessary
Baguio City	Silicified zones in volcano rocks SiO_2 — 80-92%	150,000	Crushed and sized for use as concrete aggregate and additive
Daclan, Benguet	Siliceous sinters 97% SiO_2	Limited reserve	Good ceramic quality
Tiwi, Albay	Siliceous sinters 85% SiO_2	Limited reserve	Partly opaline
Bulalacao, Oriental Mindoro	Quartzose sandstone, 84-87% SiO_2	No estimate	Beneficiation is required
Semirara Island	Quartzose sandstone, 81-87% SiO_2	Considerable tonnage	Suitable for cement additive

* Geological Survey Division, Bureau of Mines, The Availability of Clay Materials and Feldspar in the Philippines.

Through this project, two ceramics training centers have already been established, namely:

1. St. Andrew Ceramics Training Center
   Makati, Rizal
2. Libjo Ceramics Training Center
   Libjo, Batangas City

Negotiations with local government officials for the establishment of ceramics training centers in the municipalities of Ayungon in Negros Oriental, Leganes in Iloilo, Maasin in Leyte, San Nicolas in Ilocos

Norte, San Nicolas in Pangasinan, Barrio Bulua in Cagayan de Oro City, Danao City, in Cebu, Sta. Maria, Isabela, and others are underway.

Besides the NSDB-NIST other government agencies which are involved in ceramics research and development are:

1. Bureau of Mines — This Bureau conducts surveys and assessment of ceramics raw material deposits;
2. Bureau of Vocational Education — This agency prepares curriculum for ceramics courses and encourages the offering of ceramics education and training in the secondary as well as in vocational level;
3. The National Cottage Industries Development Authority (NACIDA) — The NACIDA is concerned with small scale production and marketing of ceramic products in addition to extending technical and financial assistance to individual producers and home based ceramics set-up;
4. U.P. Institute of Small Scale Industries — This institute extends technical assistance to small scale and medium ceramics entreprenuers by way of conducting surveys and preparing project studies required by financing and lending institutions; and
5. The Board of Investments — This government agency extends various incentives provided for by the Investment Incentives Act and by the Expert Incentives Act to BOI registered ceramics concerned.

The potentialities of ceramics have not only aroused enthusiasm among industrialists, capitalists, hobbyists, manufacturers, and other groups but the members of congress as well. Recognizing the significance of this industry in the economic upliftment of the areas which abound with clay deposits, congress has passed at least six (6) legislative measures for the establishment of ceramics processing plants in various parts of the country.

LAWS PASSED BY CONGRESS FOR THE ESTABLISHMENT OF CERAMICS PROCESSING PLANTS

1. R.A. 430 — An Act Authorizing the Appropriation of the Sum of One Hundred and Fifty Thousand Pesos for the establishment of a Ceramic Plant in Tiwi, Albay and for other purposes.
2. R.A. 742 — An Act Authorizing the Appropriation of the Sum of Fifty Thousand Pesos for the Establishment of a Ceramic Plant in Binalayan, Maripipi, Leyte and for other purposes.
3. R.A. 3276 — An Act Authorizing the Appropriation of the Sum of Two Hundred Thousand Pesos for the Establishment of a Ceramic Processing Plant in the Municipality of San Nicolas, Province of Pangasinan and for other purposes.
4. R.A. 3277 — An Act Authorizing the Appropriation of the Sum of One Hundred Thousand Pesos for the Establishment of a Ceramic Processing Plant in the Municipality of Sta. Maria, Province of Isabela and other purposes.

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5. R.A. 3866 — An Act Establishing a Ceramic Processing Plant in the City of Davao and Authorizing the Appropriation of funds therefor.
6. R.A. 4733 — An Act Authorizing the Appropriation of One Hundred Thousand Pesos for the Establishment of a Ceramic Processing Plant in the Municipality of San Nicolas, Province of Ilocos Norte and for other purposes.

In view of limited financial resources, only two, R.A. 430 and R.A. 742, have been implemented thru the efforts of the National Institute of Science and Technology. The Tiwi Ceramics processing plant in Tiwi, Albay is, up to now, extending technical assistance to the local potters. The ceramic pilot plant in Maripipi, Leyte has recently been turned over to the newly created Maripipi National Vocational School.

TABLE 4

SHOWING QUARTZ DEPOSITS IN FRAGMENTARY FORM*

Location	Source	Reserve (Metric tons)	Remarks
Lubang Island Occidental Mindoro	Veins in schist and gneiss gravel to boulders	No estimate	Size range from 75 mm to 150 mm in dia.
Tagkawayan, Quezon	Buit quartz in diorite, 96-97% SiO_2	45,000	Boulders 9 x 9 x 5 meters
Siruma, Camarines Sur	Crack beds pebbles and cobbles	No estimate	Iron stained
Kabangkalan Negros Occ.	Chert boulders 96% SiO_2	5,000	One meter in dia.
Roxas, Palawan	Quartz sand from quartzite, 95-98% SiO_2	2,700,000	use in glass 45% — 60 + 60 mesh
Lubang Island Occ. Mindoro	Beach and residual sand	30,000	Used as filter and sand blasting
Vito, Negros Occidental	Beach deposit	80,000	Silty
Hinobaan, Negros Occidental	Beach sand from diorite and quartz diorite	No estimate	Beneficiation required
San Ildefonso, Angat, San Rafael, Bulacan	Siliceous river sand, 80% SiO_2	Considerable tonnage	Good as cement additive
Labason, Zamboanga del Norte	Beach sand and pebbles, 75% SiO_2	46,600.000	Good as cement additive

* Geological Survey Division, Bureau of Mines, The Availability of Clay Materials and Feldspar in the Philippines.

TABLE 5

SHOWING CERAMICS EXPORTATION*
(1967-1971)

Year	Total (FOB)	Structural	Sanitarywares
1971[1]	$ 1,202,653	$1,152,771	$ 49,882
1970	654,400	582,000	72,400
1969	383,902	322,077	61,825
1968	304,880	282,494	22,386
1967	47,201	27,349	19,852
	US$2,593,036	$2,366,691	$226,345

* Department of Economic Research, Central Bank of the Philippines.

Senator Eva Kalaw, in recognizing the economic value of the industry, has proposed the enactment of a bill which would establish the Philippine Ceramics Research Institute charged with the function of coordinating all activities geared towards the beneficiation of ceramics art and craft. She has similarly sponsored, in cooperation with the Department of Education, the Philippine Ceramics Council and the Ceramics Association of the Philippines the Third Annual National Ceramic Contest.

RAW MATERIALS

The lack of raw materials is not at all a deterrent to the progress of the ceramics industry since the three principal raw materials in the modern-day process of preparing ceramic wares abound in the country. These are kaolinitic clay, feldspar, and quartz. A recent inventory of the country's non-metallic resources more specifically raw materials for the ceramic industry conducted by the Geological Survey Division of the Bureau of Mines points to places with raw material deposits suitable for the manufacture of ceramic products, (Tables 1, 2, 3, and 4). With these vast raw material resources, the ceramic industry is a potential dollar earner in addition to being a highly labor intensive industry and a viable source of indirect employment involving raw material suppliers and transportation firms.

CERAMIC IMPORT-EXPORT TRADE

During the last 5 years, from 1967 to the 3rd quarter of 1971, the import-export trade statistics on ceramics reveal that a total of US$14,036,827 worth of ceramic products came into the country comprising pottery (household, table and art wares) — $1,955,162; structural ceramics — $351,928; Ceramic insulators (electrical insulator, refractory and fire bricks and fireclay) — $11,256,884; and sanitary wares, $472,853; (Table 6).

[1] Up to 3rd quarter of 1971.

TABLE 6

SHOWING CERAMICS IMPORTATION*
(1967-1971)

Year	Total (FOB)	POTTERY		STRUCTURAL		Electric & Heat Insulators	Sanitarywares
		Household — Table wares	Artwares	Tiles	Bricks		
1971[1]	$ 3,258,898	$ 45,000	$ 19,410	$ 30,403	$ 2,403	$ 3,141,835	$ 19,847
1970	2,188,977	79,971	10,213	35,582	9,752	2,004,265	49,194
1969	2,875,005	407,083	22,025	38,575	3,810	2,318,288	85,224
1968	2,898,609	606,953	44,662	97,186	16,300	2,071,683	61,825
1967	2,815,338	665,826	54,019	95,052	22,865	1,720,813	256,763
	US$14,036,827	$1,804,833	$150,329	$296,798	P55,130	$11,256,884	$472,853

* Department of Economic Research, Central Bank of the Philippines.
[1] Up to 3rd quarter of 1971.

TABLE 7

SHOWING DOMESTIC CERAMICS PRODUCTION*
1966-1970

Year	Total	Pottery	STRUCTURAL		Various Ceramic Products
			Tiles	Bricks	
1970	P14,996,490	P 191,561	P12,959,620	P1,688,109	P157,200
1969	14,711,521	103.489	12,171,938	1,975,912	460,182
1968	14,132,700	491,488	12,729,601	897,612	13,999
1967	6.759,499	126,041	5,826,404	806,263	791
1966	4,943,855	87,772	4,541,958	309,522	4,603
	P55,544,065	P1,000,351	P48,229,521	P5,677,418	P636,775

* Bureau of Mines, Minerals News Service, 1966, 1967, 1968, 1969 & 1970.

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At the same period of time, the total foreign exchange earned by the industry through the exportation of ceramic tiles and sanitary wares amounted to about $2,593,036 of which $1,202,653 was earned during the first, second, and third quarters of 1971.

In a five-year period, from 1966 to 1970, the locally produced ceramic products were valued at ₱55,544,065 or about $8,000,000 comprising 3 categories of products namely pottery — ₱1,000,351; structural ceramics — ₱53,906,939; and various ceramic products — ₱636,775, (Table 7).

Reduction in the importation of household and artwares is expected in the near future in view of the revitalization of Mayon Ceramics Corporation which recently entered into a joint venture agreement with Consolidated Brick and Pipe Investment Limited of New Zealand, one of the world's major exporter of dinnerwares and bricks, for the local manufacture of dinnerwares. Another household wares ceramic plant is being considered to be established in the Island of Cebu. On the contrary, increase in foreign exchange earnings of the industry is expected shortly with the projected expansion of a local tile manufacturer from its present capacity of 144 million pieces to 178 million pieces per annum.

CERAMIC PLANTS

At present, there are at least 22 ceramic manufacturers in the country. Majority of them are engaged in the manufacture of structural clay products as follows:

A. Wall and Vitrified Tiles
   1. Fil-Hispano Ceramics, Inc.
   2. Mariwasa Manufacturing, Inc.
   3. Pioneer Ceramics, Inc.
   4. Elasco Commercial Co., Inc.
   5. Pacific Ceramics Manufacturing Corp.
   6. Faenza Ceramics

B. Structural Clay and Bricks Products
   1. Apalit Ceramics Manufacturing Co., Inc.
   2. Aurea Industries Inc.
   3. Sta. Maria Ceramics Co., Inc.
   4. Era Industries Inc.
   5. Firestone Ceramics
   6. Clayburn Ceramics
   7. Dubricon Ceramics
   8. Ferro Far East Limited
   9. Ceramics Masters Inc. (Artware)
   10. Pyrotron Ceramics

C. Sanitary Wares
   1. Sanitary Wares Manufacturing
   2. Republic Ceramics, Inc.
   3. International Ceramics

D. Dinnerwares
   1. Mayon Ceramics Corp.
   2. Ceramic Industrial Corp.
   3. Kermac Industries

The Manufacture of tiles of exportable quality utilizes at least 80 percent raw materials that come from indigenous sources while dinner and sanitary wares use at least 65 percent locally available materials. The others use 100 percent indigenous materials.

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PROBLEMS AND FUTURE OF THE CERAMICS INDUSTRY

The main problem being encountered in the task of developing the ceramics industry is that of financing. While the technical aspect of the industry have been studied intensively, the results of such studies could hardly be utilized due to lack of capital. It is a labor intensive as well as capital intensive industry.

Another major problem that beset the ceramic industry is the lack of facilities for the exploitation and development of the country's clay resources. There is hardly a plant solely engaged in mining and beneficiating of clay materials to cater the needs of the industry. While there are a few small groups engaged in these works, they are the ceramic manufacturers themselves.

Various technical problems and the lack of skilled and semi-skilled manpower are similarly encountered more particularly by the household and art wares manufacturers.

While the ceramic industry has not grown at a remarkable pace, it is slowly gaining strength as a dollar earning industry. A review of the ceramic statistics on import-export reveals that the industry has been on a steady climb in the last five years contributing about ₱2,593,036 of which ₱1,202,653 was earned during the first three quarters of 1971. This is at least the status of the ceramics industry today. With the reactivation of Mayon Ceramics Corporation of its dinnerware manufacturing activity and the implementation of the expansion program of the tile manufacturers, there is more reason to expect that within the span of the next five years the amount of foreign exchange earning capacity of the industry to a much higher level.

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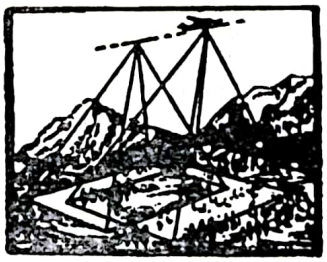

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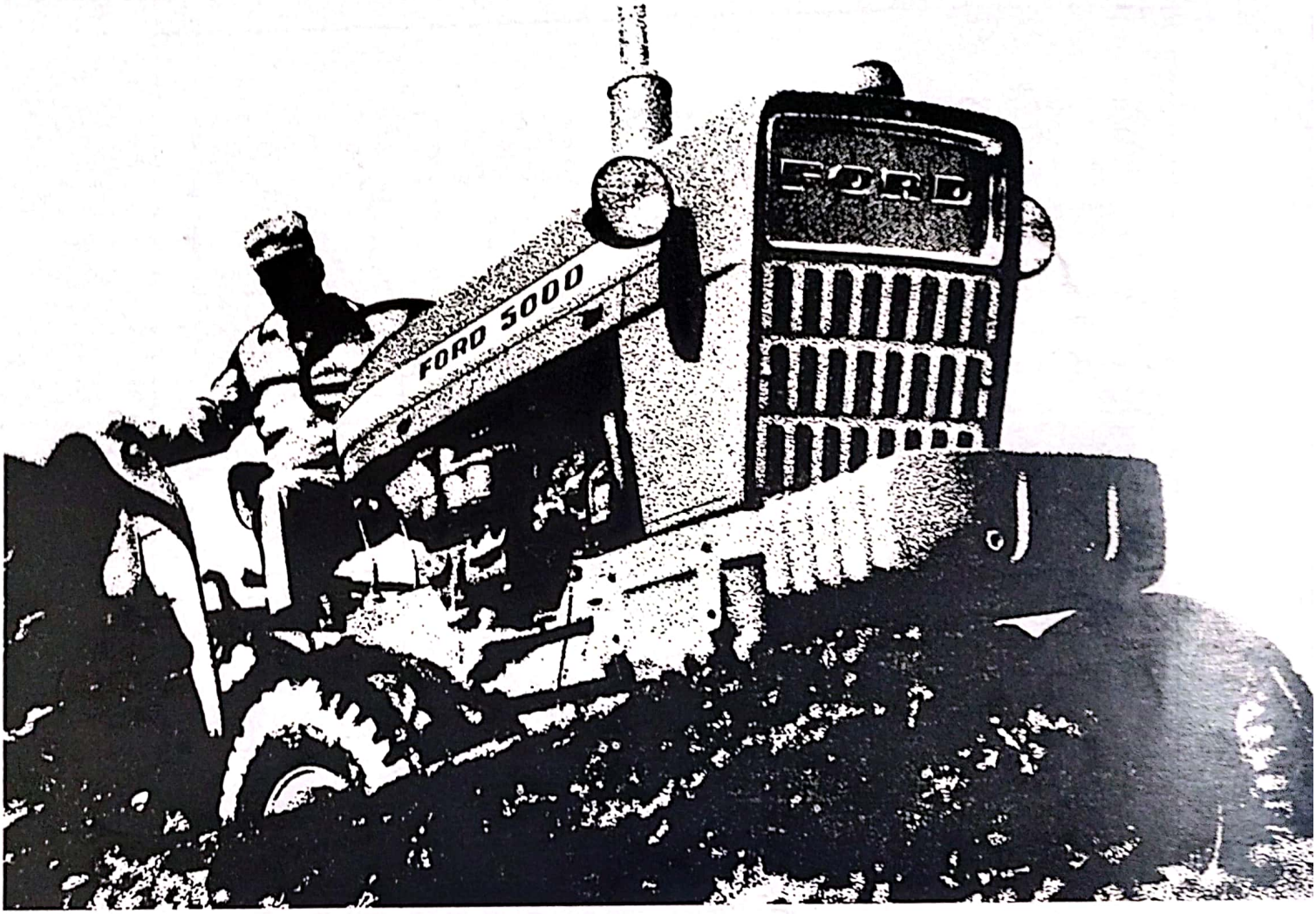

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