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OF GRAVELS FROM PATAGONIA, ARGENTINA

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SURFACE PROPERTIES AND EPIGENETIC FRACTURES OF GRAVELS¹ FROM PATAGONIA, ARGENTINA

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ABSTRACT

This paper deals with some surface properties of gravels from Patagonia, which have been called "tehuélches" gravels in the geological literature. These properties are produced by diagenesis of the deposit when in place, but once the pebbles are removed, they change their shape and original features. Measurements of more than one hundred clasts have been made. Differences between original and fragmented clasts are shown in text and illustrations.

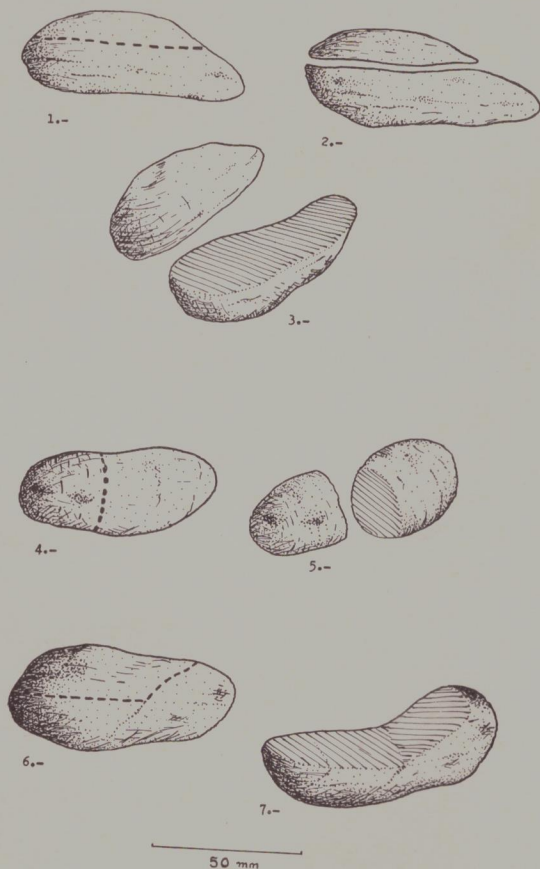
INTRODUCTION

Shape, flatness, roundness, size, and surface characteristics of the clasts of psephitic sediments are closely related to processes and means of transportation of these sediments and their ultimate deposition. It is significant that in most cases these properties may lead to wrong conclusions when the sediments are not studied in place. It is most necessary to make all possible observations of the characteristics of the clasts in the original deposit in the field. The gravels referred to as "tehuélches," are psephitic sediments which in Argentina cover a very wide area, extending from the south of the Province of Buenos Aires (Río Colorado), parallel 39°, southern latitude, to the south of the Province of Santa Cruz, parallel 51° 30', southern latitude, and they cover an important part of the Patagonian plain. These deposits are generally unconsolidated; however, in a few areas they are strongly cemented by lime and calcium sulphate as gypsum. They vary in thickness (up to five meters) and have very peculiar sedimentological characteristics.

The age of the sediments is not clearly established and the opinions of the various authors who studied these deposits vary from Miocene to Holocene (Feruglio, 1950), (Auer, 1956, p. 17), (Flint, 1959, p. 87).

For the origin of these gravels there is no agreement, as yet, and the authors believe them to be of marine, glacial or fluvio-glacial origin.

We can safely say that, according to our studies, that there is no evidence of glacial phenomena; we have not observed on the clasts' surfaces any striations nor have we noted the



- 1.—Specimen seen in profile.
- 2.—The same specimen divided according to its fractures.
- 3.—The same, seen from the above.
- 4.—Line of fracture marked by dots.
- 5.—The same specimen separated by its fracture.
- 6.—Two planes of fractures are seen and cut.
- 7.—The same specimen showing the surface of the fracture.

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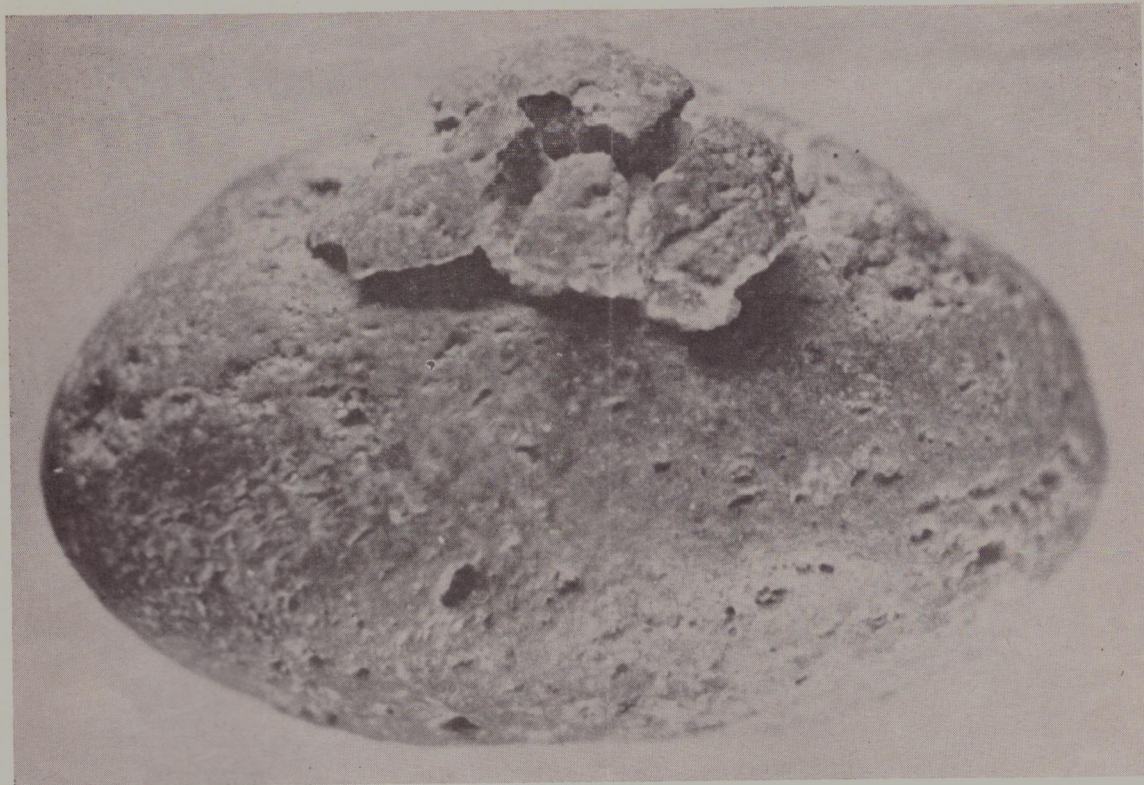


FIG. 8.—Specimen, in which the scaling produced by gypsum crystallization can be seen in the superficial fissure and which has divided the fragment into four smaller pieces. These are seen adhered to the major portion by the gypsum. Magnification, $1\frac{1}{2}$.

typical shapes of glacial clasts. The detailed study of the petrofabrics of these deposits, has not revealed either the characteristics of glacial

sediments nor those of fluvio-glacial origin. At present, one of the authors (Cortelezzi and others, 1963), is working on this matter and his

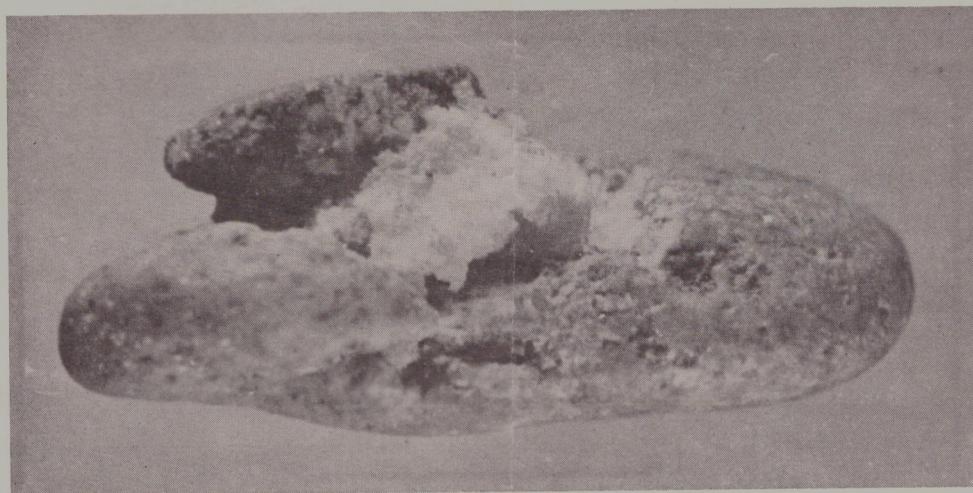


FIG. 9.—Photograph of one specimen as seen in profile. Observe how the crystals of gypsum placed in the fissure have lifted one of the upper parts of the clast but have not broken completely away. Magnification $1\frac{1}{2}$.

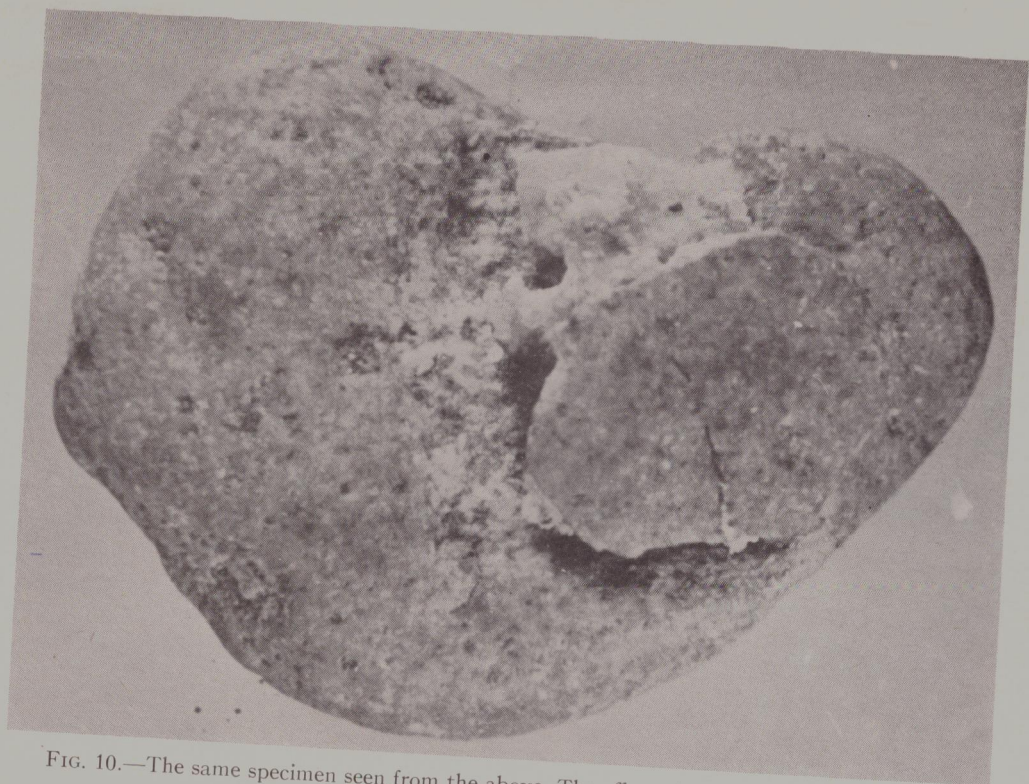


FIG. 10.—The same specimen seen from the above. The effect of scaling can be seen as well as gypsum crystals. Magnification $1\frac{1}{3}$.

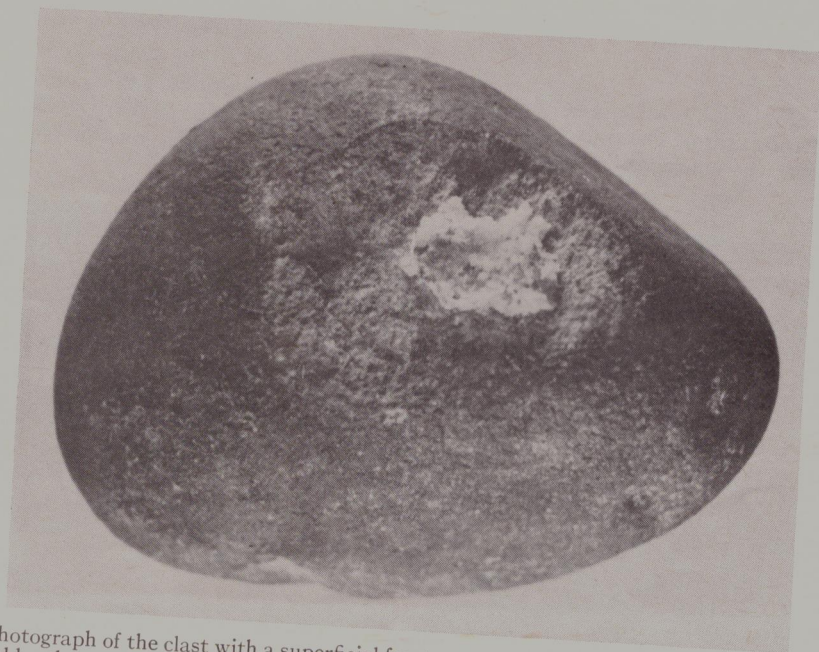


FIG. 11.—Photograph of the clast with a superficial fracture apparently produced by percussion, but which in reality is caused by the same phenomenon as above. The gypsum crystals can be seen adhered to the surface but the scaling fragments have disappeared. Magnification $1\frac{1}{2}$.



FIG. 12.—Photograph of a fragment of tuff showing the bedding planes, corresponding to measurements in table 1. Magnification $1\frac{1}{3}$.

conclusions will help us to understand some problems related to Patagonic gravels.

We assume that the phenomenon of deposition of the gravels called *tehuelches*, possesses geological characteristics that cannot be compared with other sediments in other areas mentioned in the geological literature, and such dispersal of gravel, as well as its thickness, is one of the most puzzling problems in Argentine geology.

SURFACE CHARACTERISTICS AND FRACTURES

According to different authors, the following types are mentioned among the surface characteristics of sedimental clasts: striations, impact scars, percussion marks, pitted pebbles, fractures, and so on (Pettijohn, 1957, p. 68-72).

In the study of *tehuelche* gravels, we have observed some characteristics not described before which we consider of interest as they constitute another possibility of fragmentation of gravels or formations of surface marks. These phenomena are not the result of transportation neither of abrasion nor are they caused by differential solution. They are present in general in gravels of tuffs, which are of crystalline and

crystalline-lithic textures. They can be grouped in two types:

- 1) A certain number of clasts are broken upon their removal from the original deposit; the ruptures follow a certain set pattern within the clast. Observing these fractures thoroughly, it is evident that they are the result of preexisting fissures and bedding planes of the tuffs. We have also observed that these fissures are filled with tiny crystals of gypsum, arranged perpendicularly to the fissure walls. These gypsum crystals are deposited by the action of flowing waters which in this area are considerably enriched in sulphate. The strength of the crystallization of these crystals brakes the original clast into two or three smaller clasts which differ in shape from the original one. When a textural analysis of gravels is performed it is possible to come up with incorrect interpretations about the flatness, roundness, sphericity, and size of the original clasts of the sediments. Figures 1, 4, and 6 show the original clast with the more common types of fissures, and 2, 3, 5, and 7 show the smaller fragments as the result of the rupture.

It is important to consider these observations

in relation to deposits of gravels in which sedimentary rocks are predominating, as the filling originates through the bedding planes and the fragmentation in flattened clasts leads us to believe in a mechanism of transportation, which is not real. We emphasize that in general this phenomenon is observed in the lower part of the deposit of gravels. A cementation with lime and gypsum predominates in the upper strata. In the lower parts of the deposits gypsum covers the fissures or the spaces left between one clast and another.

2) Another type of surface of clasts is shown in figures 8, 9, and 10; here gypsum has been deposited in fissures which are more or less superficial and which did not divide the clasts on crystallization but produced a superficial rupture, that is to say, a scaling. This phenomenon can be observed in the clasts which are in place; clasts which are removed from the deposit easily lose their smaller fragments and then an examination may lead to false interpretations that mechanical processes affected the surfaces of the gravels.

Measurements of more than one hundred

clasts have been made, the corresponding measures, as an example, made on one gravel deposit, are as follows:

TABLE 1.—Measurements of clasts from gravel deposit

	Original	Fragmented
a:	53,5 mm	53,5 mm
b:	44,5 mm	44,5 mm
c:	27,1 mm	20,4 mm
Flatness:	1,80	Flatness: 2,40

The measures of gravels as illustrated in the following laminae are:

	Figure 8	Figures 10 and 11
a:	56,7 mm	47,8 mm
b:	44,1 mm	31,5 mm
c:	34,8 mm	14,0 mm
Flatness:	1,44	Flatness: 2,83

The gravels studied were taken from deposits near Zapala, Cerros Colorados, in the Province of Neuquén, Argentina.

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