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**Prévention des risques d'érosion et de submersion
littoraux: la connaissance du risque, les études
d'impact en vue des travaux de protection**

*Prevention of coastal erosion and submersion
risks: knowledge of the risk, impact studies
with a view to protection works*

**Organisé par le Centre Européen sur les Risques
Géomorphologiques**

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Sous la Direction de
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**MARINE EROSION AND LANDSLIDE
ACTIVATION AT VILLERVILLE**

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In the Villerville-Cricqueboeuf area, the sea disperses material from the foot of the landslide. In so doing, it helps to reduce resistance at the toe of the slide and to facilitate further slippages. But to what extent does it play an essential role, or only a very subordinate one, in relation to the water which impregnates the slope formations, the higher piezometrical level during periods of heavy rain and the movements which may result from that ? It has been shown that water conditions in the slope do indeed play the essential role. Rocks have been laid at the top of the beach on either side of Villerville. They do not sufficiently increase resistance at the toe of the slide to prevent further slippages from occurring, but they do provide protection against marine erosion and delay, or slow down, slippages in the two basins. Cirque des Graves and Fosses du Maere. Villerville has for a long time been protected by a wall on the seaward side, because the most important issue is the fate of the town. Can it be affected in the short term by phenomena of instability related to lateral extension of the two basins on either side of it ? Above all, however, is

there any risk of mass movement of the entire slope, including the slope on which the town is built, as is happening in the two basins ?

Observation of a natural section at the base of the cliff, between two retaining walls and above the sea wall, has shown that Villerville's substratum was formed by the filling of a paleovalley with superficial Quaternary formations of the head, sand and loam types. This hypothesis, which was at variance with that previously put forward, namely the existence of a large chalk block underlain by marls, was tested in order to dispel the uncertainties relating to the nature of the town's geological base and evaluate the risk of instability.

To this end, an exploratory borehole with a diameter of 160 mm was drilled by the C.E.T.E. of Rouen in the town centre, on the centre line of the Villerville valley.

This borehole (ST 6), whose head is situated at an altitude of 27 m IGN 69, was drilled to a depth of 20 m, ending in compact blue marls at an altitude of

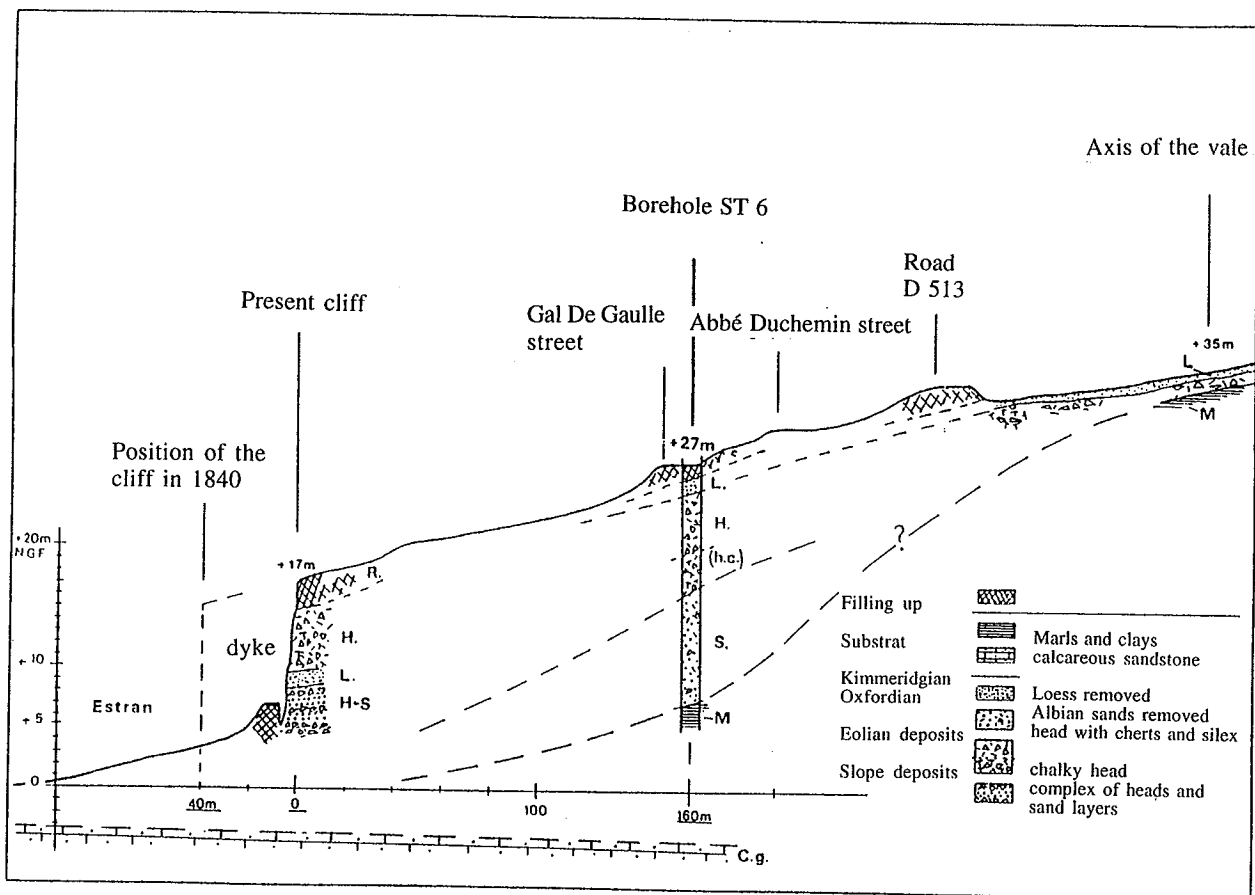


Fig. 1 Profile of the slope at Villerville

EROSION MARINE ET ACTIVATION DES GLISSEMENTS A VILLERVILLE

approximately 7 m IGN 69 (fig. 1).

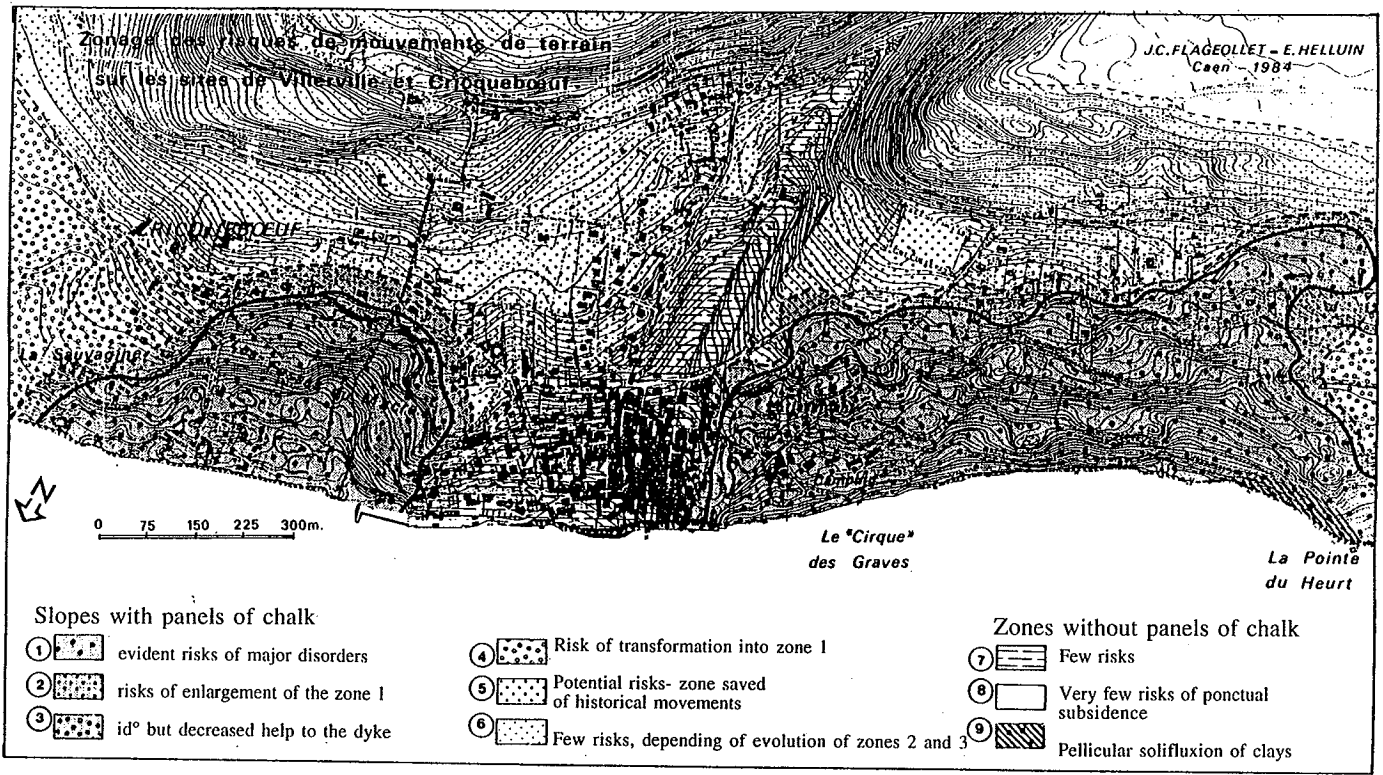
The successive formations encountered are :

- 0-1 m : fill ;
- 1-2 m : calcareous loess with many small flint splinters ;
- 2-9,5m : head with flint splinters, chalk fragments and clay lenses;
- 9,5-19,7 m : reworked Albian sands with flint fragments and splinters;
- 19,7-20m : compact blue marls. Refusal.

In the schematic geological profile made along the centre line of the valley, matching the various formations encountered when drilling the borehole with those mapped on the cliff by J.C. Flageolet and E. Helluin (1984) may present certain problems. Firstly, with a drill it is not possible to see whether the sand has been reworked or not. Secondly, the difficulty in linking up the various formations surveyed on the cliff itself with those encountered when drilling the borehole is due to the fact that the use of a twist drill destroys structures and mixes the various small sedimentary beds. However that may be, the formations identified are very similar. The head is simply much

chalkier between the depth of 7,2 and 9,5 m in the borehole than in the section of the cliff.

No chalk block, was drilled through on the centre line of the valley. The regular incline of the slope on which the town is built, no doubt partly a result of construction work, closely matches the slope (in terms of gradient and direction) of the surfaces of Norman coastal head deposits. Chalk blocks are to be found, however, on the side of the Cirque des Graves : they are visible on the blockhouse and the "Le Bouloir" villa. This fully confirms the hypothesis of the filling of a paleovalley with superficial Quaternary deposits. Hence, in Villerville itself, the hypothetical chalk blocks accompanied by their cushion of glauconitic sand resting on clays and marls as in the case of the two basins subject to instability, are felicitously replaced by a permeable sandy formation which both explains Villerville's current stability and provides reassurances as to its future. However, further disturbances in the two basins (Fosses du Maere and Cirque des Graves) may eventually lead to problems of instability on either side of the town, owing to lateral extension (Fig. 2) of the area in motion.



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Fig. 2 Zoning of risks of landslides in the Villerville and Cricqueboeuf area.