Thinking on the risk connected with the Super Sauze landslide.

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1. POSSIBLE AND PROBABLE HAZARDS

1.1. Lengthening and descent of the flow into the torrent bed.

Both are mainly conditioned by the addition of new of material, by fall or sliding at the expense of the crown.

- There are morphological indications of this future withdrawal in two places, two curved escarpments are outlined, delimiting two compartments of a rather restricted surface area and therefore of modest volume. Movements in these sectors are recorded; these recordings will be a guide to our thinking regarding the imminence or otherwise of the fall or sliding of these compartments.

- The structural conditions in the main escarpment, in particular the very tilted dip downstream facilitates detachments, slides and falls of slabs and panels which could occur suddenly.

- The two lateral torrents and the intermittent falls onto the flow act inversely; every time there is heavy rainfall and whenever the snows melt they take up and export the material in the flow and the debris flow diminishes in volume.

- Over several decades the balance between these two opposing actions has favoured the first, that is a rise of the volume and an extent of the flow, as mentioned in the first paper. Between summer 95 and summer 96, in contrary, the balance is in favour of the second action. The surface of the flow fell in the middle section and the interflow crests of old gullies were progressively exhumed. We may add that a recurrence of gulleying was evident in the main escarpment over the same period and we are tempted to say that if this recent development continues steadily the network of old gullies will be re-established and that this landslide flow will disappear by itself.

- This descent of the flow downstream into the torrent bed depends on another factor, this time topographic. The foot of the flow has reached the end of the catchment area for all the gullies in the sector; almost at the entry to the drainage channel where all branches of the Sauze river converge. The constriction of the marl walls in situ is an obstacle to its progress. The length of this drainage channel (figure 1) is such that the flow cannot go very far. This could be confirmed, particularly after the volumes of moving material have been calculated.

1.2. Occurrence of torrential lava.

Rapid superficial mudflows occur occasionally, mainly in spring, so the moving marl can lose consistency and liquefy, generating a dangerous torrential lava if there are strong or exceptional rainfall. This is the kind of hazard which was feared at La Valette and which

prompted the works we already know about, particularly in the catchment basin of the range. This potential hazard has two vital characteristics - intensity and probability; as yet we haven't enough data to define them more closely.
What volume of lava can be expected? It is improbable that the whole of the moving mass will be transformed into liquid mud if the lowest layer remains impermeable and the absence of a deep and continued water table is confirmed. The phenomenon should be circumscribed at the upper layer, at least in part.

What are the intensity thresholds for hourly and daily rainfall which must be exceeded if this uppper layer is to be transformed into torrential lava? As the phenomenon has not occurred since the landslide appeared it would be interesting to know the daily maxima for the last forty years.

In conclusion, torrential lava seems to be the possible hazard; its intensity and its probability are yet to be established.

2. EXPOSED ELEMENTS AND THEIR VULNERABILITY

2.1 There is no vulnerability in itself; it must be considered as a function of the torrential lava risk envisaged, which is damaging or destructive under the effect of three types of solicitations: the *impact* of blocks, trees and various objects transported, frontal and lateral *thrust* and *accumulation* and coverage.

2.2 The only exposed elements in the channel of the torrent are the bridge and the Conchette road. The essential is on the torrent's old dejection cone, which extends over 6 sectors and mainly comprising the two bridges, the two roads, the farm and the Chaup Haute camp site, and the Pont Long estate, 97 houses in all, each with several entrances, electric and telephone cables. The zones affected by torrential lava could only be delimitated by intensity scenarios when we have established a maximum and a minimum for them. The number of elements exposed and the nature and degree of damage expected will lead us to an evaluation of the risk, including personal loss and economic disruption.

The installations on the river bed and banks which protect the east side of the estate (figure 3) (dyke, drainage channel threshold, etc.) seem capable of containing a considerable quantity of lava, of facilitating its arrival in the Ubaye and of preventing an overflow.

For the future we wonder about the fate of some of these elements which appear to be seriously at risk, regardless of the quantity of lava. These are the bridges, given their height and their position. For example, the bridge over the Sauze in front of the confluence with the Galamonts stream (figure 2), in a torrent elbow 4 m. above it, risks being blocked by rocks and treetrunks. An overflow onto the road to Chaupe Haute is possible, if not probable.

It seems that this eventuality has already been envisaged and that works are being planned.

3. CONCLUSION

In our opinion the Super-Sauze landslide is a risk which someone - state body, civil engineering office or research centre - should assess as far as possible. Some operations in our own research programme need to be continued over several years if sufficient data is to be collected. In particular it is unlikely that we will have the funds to carry out further drilling, unless the need to clarify some uncertainties or to identify the risk induces the authorities to make the necessary financial effort..