

# SEDIMENTOLOGICAL STUDY OF DISTAL RAIN-TRIGGERED LAHARS: THE CASE OF WEST COAST OF ECUADOR

## PROBLEM

Lahar is the event of remobilization of loose volcanic materials that can generate high-concentration sediment loaded flows, composed by sediments and water (Smith and Fritz, 1989). The lahar event may be triggered directly by the eruptive event (primary lahar) caused by failure of a crater lake or "water" volcanic eruptions. This kind of geological event may be due to a remobilization of the volcanic material by heavy rain events even years after the eruption (secondary lahar) but it can be triggered also without heavy rain events

## MAIN GOAL

The main goals are to explain what kind of events have generated these deposits and how these events affected this area. This study presents an unrecognized hazard for the coastal sector of Ecuador and that nowadays can affect the population of this sector, even if sited ~160km far from the nearest main eruptive centers.

## METHODOLOGY

To better characterize the ash deposits, 32 stratigraphical sections, sited in the area comprised between Salango and Jama (Manabí province - Ecuador) were described and laterally correlated. The main stratigraphic units were recognized by raw contacts, lithological features and by the presence of palaeosoils. Three samples (2 bulk palaeosols samples and one composed of charcoal fragments) were <sup>14</sup>C-dated with the AMS methodology at the Beta Analytics Laboratories (Miami - USA). The grain-size analysis was made at ESPOL (Escuela Superior Politécnica del Litoral - Guayaquil) on dry samples into full steps of  $\Phi$  ( $-\log_{10} d$ , with  $d$ : grain size in mm) between  $-6\Phi$  and  $8\Phi$ . The principal statistical parameters were calculated according to Folk (1980) using the free software SFT

## RESULTS

**The deposits F1** crops-out on the coastal sector of Jaramijó (Unit A, B), in Chirije (Unit F - near Bahía de Caraquez), San Vincenzo (Unit G, H) and near San Lorenzo. This type of deposit is cm to mm-thick, matrix-supported, finely parallel laminated to massive that fill the palaeo-valley.

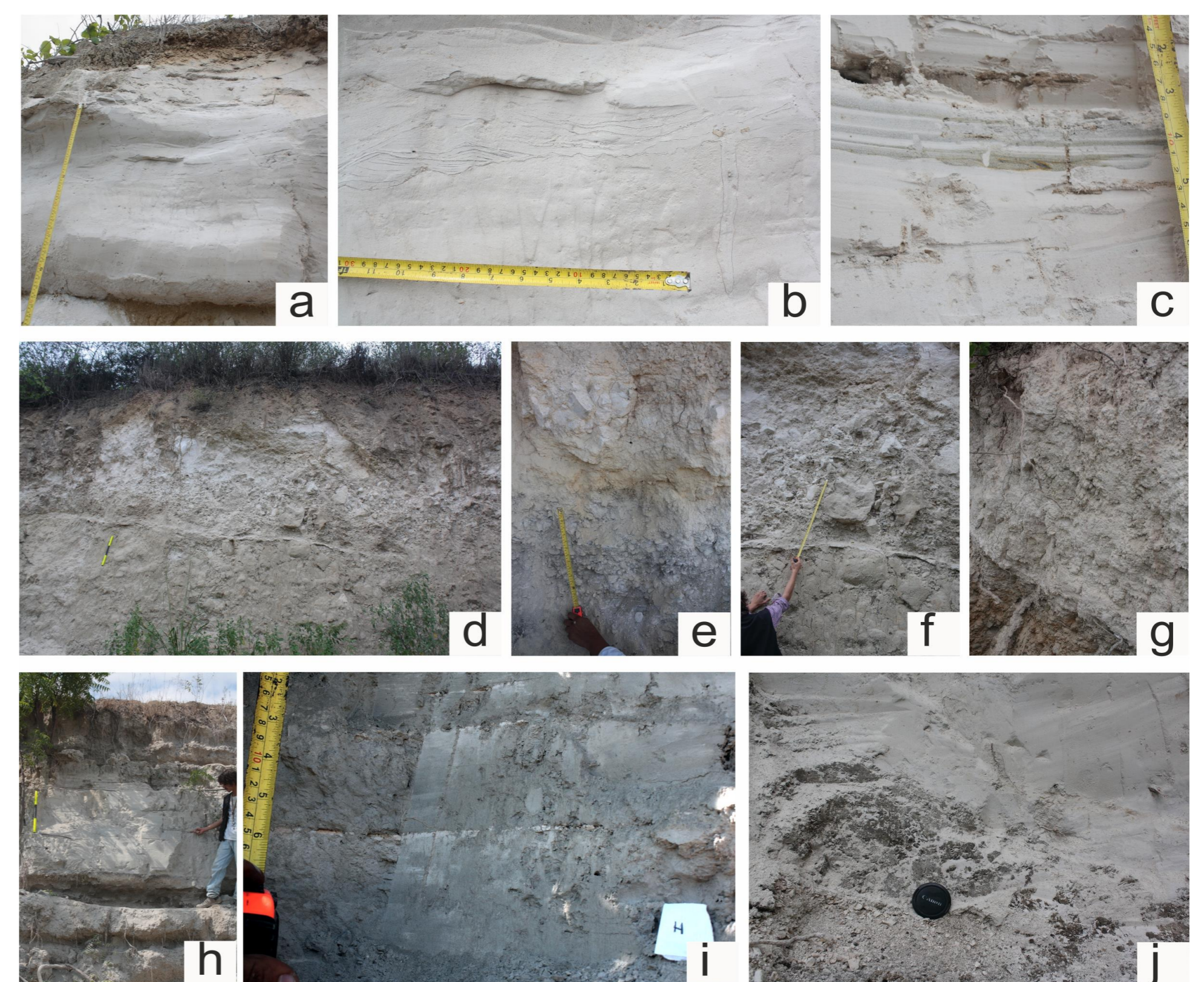
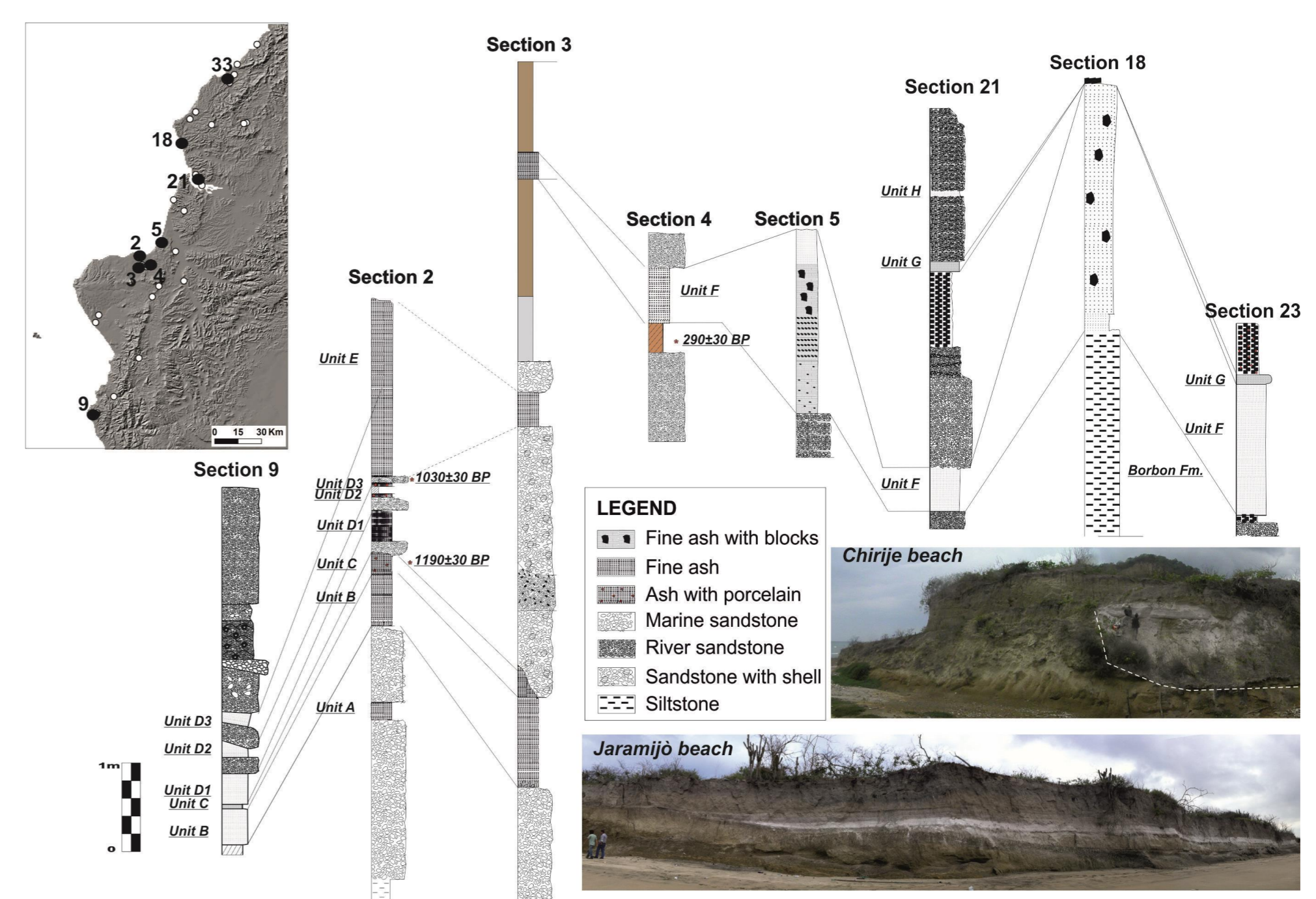
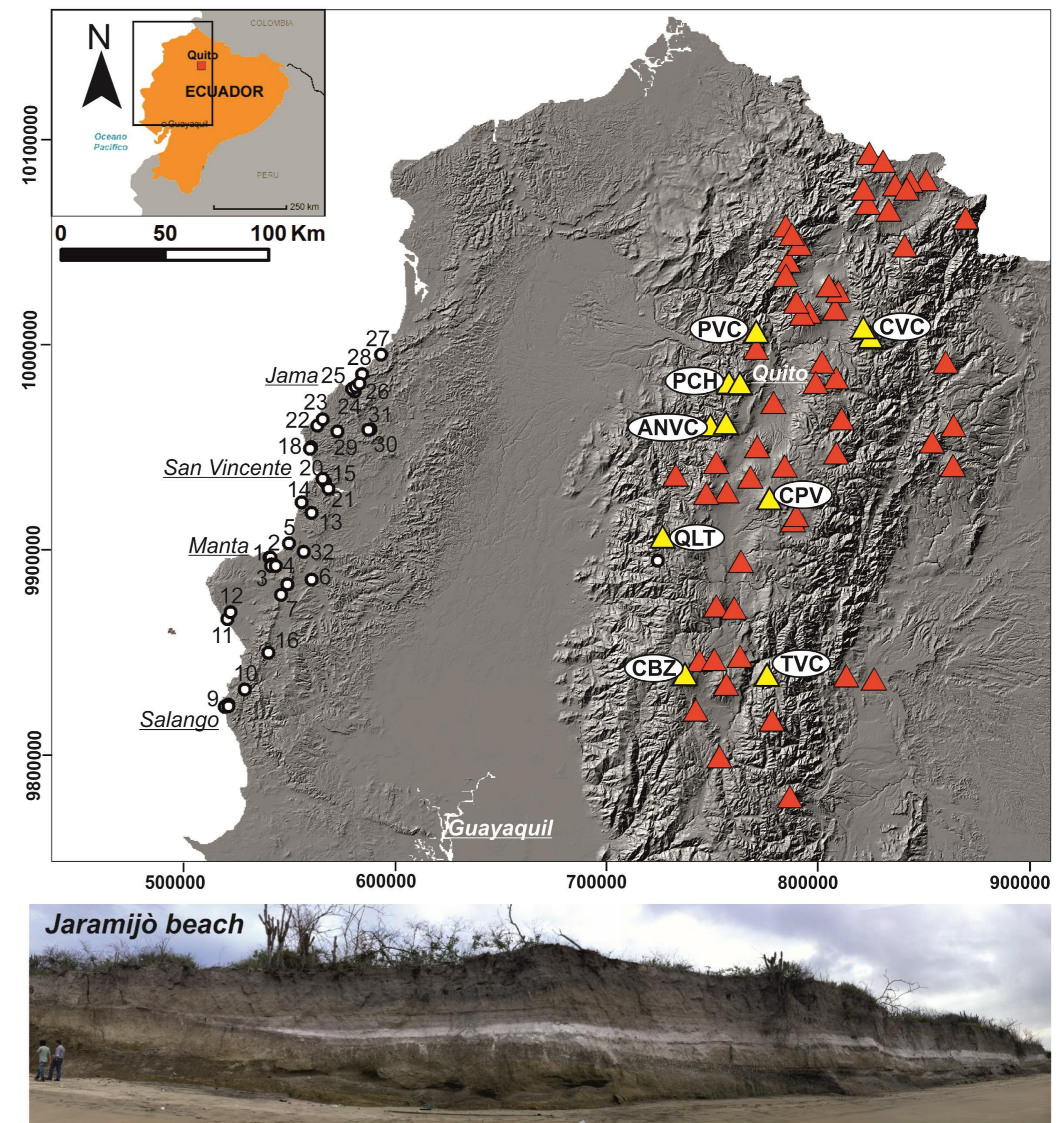
**The deposit F2** is very valley pounded, do not crops-out continuously along the sector and it was observed in Jaramijó (Unit D and Unit E), Crucita (Unit F), Canoa (Unit F), San Vicente (Unit F) and Jama (Unit F). The deposit is structureless and rarely matrix-supported. It consists of medium ash, m-thick, no-imbricated, very poorly sorted matrix with large (max. size 40 x 20 cm) angular to subrounded lithic blocks and mm- to cm-sized subrounded pumice.

**The deposit F3** is partially valley confined and locally it presents over banking evidence. It crops-out in Jaramijó (Unit C), San Vicente, Crucita (Unit F), Manta (Unit E) and Salango. The deposits consist of multiple, massive, poorly sorted fine ash layers.

**The deposit F4** crops out in Jaramijó (Unit D) and San Lorenzo (Unit D). It consists of faintly stratified, coarse-grained ash with poorly to very poorly sorted matrix. This deposit contains lithic and pumice clasts aligned which producing stratification. The deposits show sharp contacts both at the bottom and at the top.

## CONCLUSIONS

In Ecuador, the ash deposits are present both in proximal vent sector as Pyroclastic Density Currents, primary lahars and fall-out deposits and in the coastal sector as fall-out deposits. Ash deposits related to lahar events in the area comprised between these two sectors were not previously described. The presence of large boulders in the coastal deposits and the lack of volcanic deposits in this area comprise between the volcanic area and the coastal area support the idea that the deposits related with lahar event can be related principally with secondary remobilization processes triggered in the coastal sector.



Details of the main lahars deposits outcropping in the west coast of Ecuador: **a)** The picture shows as the deposit F1 in Chirije is finely parallel laminated to massive filling a palaeovalley. Scale bar = 8 cm; **b)** Cm-sized ripples and water pipes structures present into the deposits F1 show testify a water saturated deposit; **c)** Scour and fill structures testifying reworking processes by water of the upper portion of the deposits in a shallow water environments; **d)** Valley pounded deposit F2 in Canoa characterized by the presence of metric sized boulders. Scale bar = 60 cm; **e)** Very poorly sorted matrix of the deposit F2 in Crucita with high percentage of boulders. Scale bar = 10 cm; **f)** Detail of meters sized sub rounded boulders into Deposit F2. Scale bar = 10 cm; **g)** Cm-sized lithic lapilli in faintly stratified deposit F4. Scale bar = 15 cm; **h)** Multiple massive poorly sorted fine ash layer of the meter thick deposit F3 in San Vicente. Person for scale = 170cm; **i)** Very fine compacted ash layers at the top of single layers in the deposit F3 in San Vicente. Scale bar = 8 cm; **j)** Fine ash intruded into surface irregularities in deposit F3 due to the presence of superficial voids: camera lens = 8.6 cm.

