CHAPTER VI

Eruption Model of Khao Rawang

From the study of the succession of pyroclastic deposits at Khao Rawang couple with theoretical analysis and modelling for eruption events of many works (Sparks et al., 1973; Sparks and Wilson, 1976; Bond and Sparks, 1976; Rowley et al., 1981; Sheridan et al., 1981; Cas and Wright, 1987; and Branney, 1991), it is possible to trace the progress and changes in eruption events at Khao Rawang to a first-order approximation.

After a period of unknown duration following the earlier basaltic andesite lava effusions, the eruption at the north of Khao Rawang (inferred source vent area) began to take place either when the gas pressure within the magma chamber became sufficient to rupture the conduit to the surface or, less likely, with the introduction of a new batch of hot magma from depth (Sheridan at el., 1981). The initial eruption followed the model of Sparks and Wilson (1976); beginning with decompression due to exsolving magmatic gas driving the gas thrust during the opening and widening of the conduit. Buoyant convective uplift of particles above the continuous gas thrust zone produced a persistent eruptive column from which the pumice-fall deposits were derived (Figure 6.1a).

The initial eruption apparently produced the white highly fractionated pumice fall with some of basaltic lithic

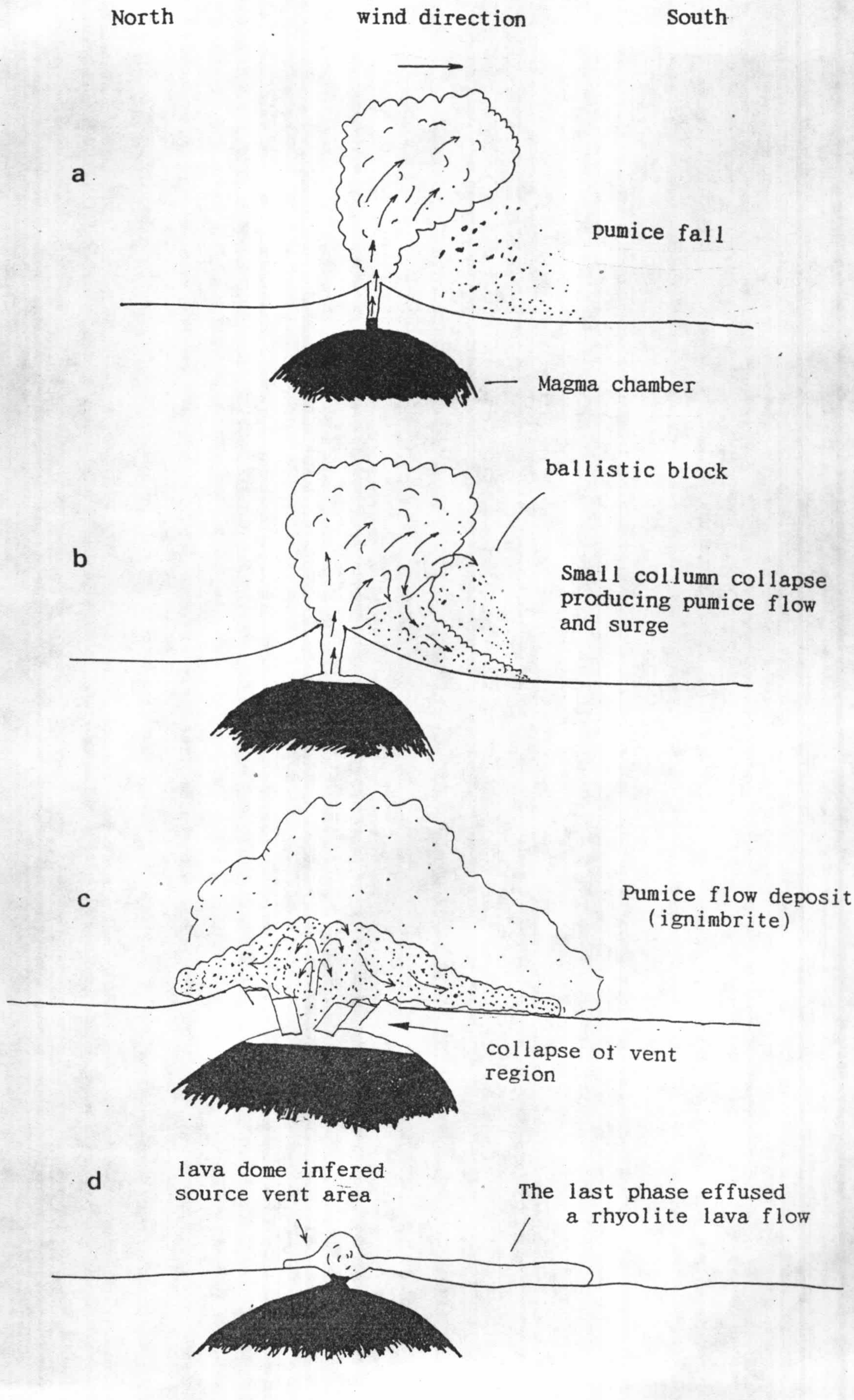

Figure 6.1 Schematic diagrams showing different phases of eruption events at Khao Rawang.

clasts, which the marginal depositions of these deposits have mostly been covered by solid and/or epiclastic sediments of the later weathered products, while at the top they subsequently overlain by a number of small pumice flow and fall units (eruption units 1 to 6). This sequence indicates that as the eruption proceeded until the eruption column verging on collapse (the density of eruption column nearly or equal to the density of the surrounding atmosphere), at this stage, there are changes or slight fluctuations in gas velocity and mass discharge rate. For instance, gas velocity decreases or a sudden increase in mass discharge rate, which both caused instabilities in the eruption column and led to small collapse events (Figure 6.1 b) producing a number of small pumice flow and ash-cloud surge interbedded (eruption units 1, 2, 3 and 4). Subsequently, a convective column could then be re-established with a slight increase in gas velocity due to a small increase in gas content of the magma, which the pumice fall deposits (eruption unit 5) were derived again.

After that the eruption changed notably and produced a single flow deposit of the greater density, size and volume of mostly juvenile pumice clasts. This abrupt change from fall to flow-forming activity is thought to have been caused by a sudden and drastic increase in mass discharge rate, and can not be simply due to the collapse of the very high pumice-fall column. This suggests that the high eruption rate during the early pumice-fall and flow phases drained the upper part of the magma chamber, leaving its roof unsupported. This eventually led to major collapse of the vent region (Figure 6.1 c). This greatly widened the vent, and the large pumice-producing flow (ignimbrite) was then formed by instantaneous column collapse, the mass discharge rate being suddenly much greater than that which would allow for the maintenance of a stable convective column (Figures 6.2 a and b). A sudden increase in the volume and size of lithics in ignimbrite support the idea that there was a drastic change in eruption conditions.

Field evidences suggest that the parent flow ignimbrite erupted only a short time in batch of only juvenile pumice clasts which gradually coalesced, and flow as a single wave of material. During the most of its passage, the flow consisted of a flow head (strongly fluidized by ingested air) which generated layer 1 deposits (ground surge and ground layer), and the body plus tail of flow which generated layer 2 deposits (Figure 3.23). The flow-head was highly erosive and locally, almost unbelievably, scalped and overturned the floor over which it rode (Figure 3.21). A variety of processes acting in sequence to fluidization or flow kinetics operated within the flow to produce the great variety of depositional facies.

Finally, the last phase of eruption produced the volatile-poor magma which reached the surface as a rhyolite lava flow (Figure 6.1 d) overlying on the top of the successive deposition.

Throughout the succession related to the eruption sequence, it is possible to subdivide the succession into:

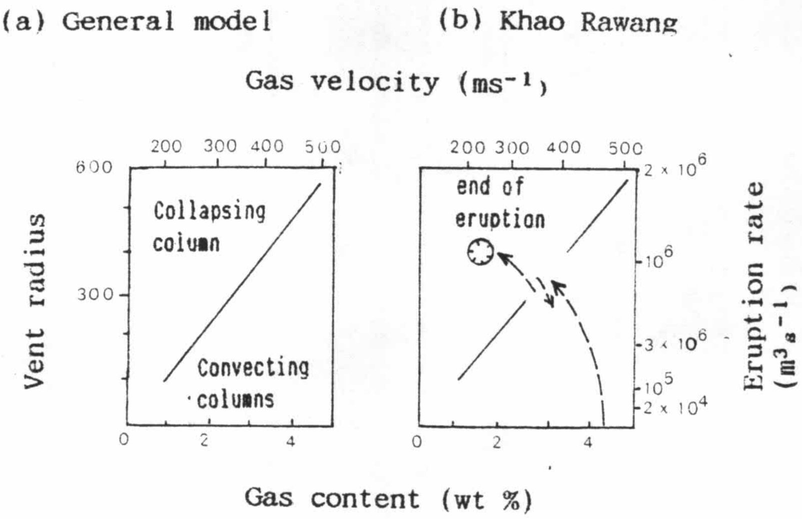

Figure 6.2a General model showing plot of vent radius, gas content, eruption rate and gas velocity, relating these parameters to convective plinian and collapsing ignimbrite-forming eruption column (after Cas and Wright, 1987).

Figure 6.2b General model initiating the changes of physical conditions during the eruption at Khao Rawang.

(a) the early air-fall phase producing pumice-fall deposits with a number of small pumice flow and surge,

(b) pyroclastic flow-phase producing ignimbrite,

and (c) effusive-phase producing lava.

And this eruption sequence can illustrate as shown in Figure 6.3.

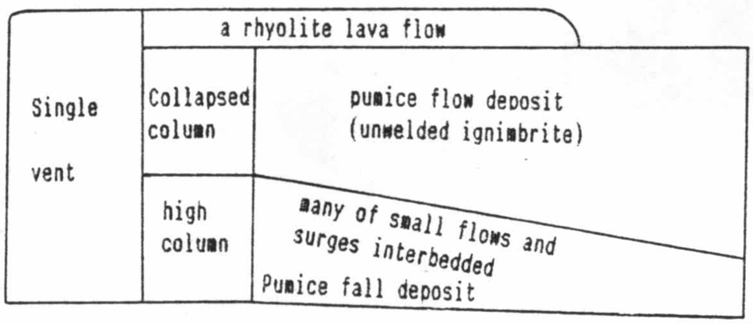

Figure6.3 Depositional facies model for eruption events based on the deposit succession along the southern cliff of Khao Rawang.