Petrographic and geochemical study of the volcanic rocks in drill core from explosive crater in Chihsingshan

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Summary

Minerals with cracks were observed in samples from Yachi and Jin Lu Tian Gong, indicating that the ascent of magma led to a rapid decrease in pressure. Resorption zones were identified in all samples, suggesting an increase in temperature, decompression, or the incorporation of magmas with different compositions. All samples from Yachi and Jin Lu Tian Gong exhibit amphibole breakdown reaction rims, indicating amphibole dehydration. The explosive craters on both the eastern and western sides have a moderate potassium content and belong to the calcium-alkaline series.

Survey region & Sample

The Chihsingshan volcanic fields have two explosive craters, one is east of explosive craters ,the other is west of explosive crater. The samples for this study were collected from Yachi and Jin Lu Tian Gong, located west of the explosive crater. This study focused on drilling at the explosive crater on the western side, and conducted a comparative analysis with the results from the eastern side. This aimed to know deeper into the composition of volcanic lavas or volcanic rocks prior to the eruption at Chihsingshan.Through this, the study inferred the characteristics of volcanic magma activity at Chihsingshan.

The drilling depth of Yachi is 50m.
We make thin sections from it at depths of 11m,21m,30m, and 50m, and labeled them as YC-C11, YC-C21, YC-C30, and YC-C50.
Major element analysis was performed on samples taken from depths of 11m、30m、50m.

The drilling depth of Jin Lu Tian Gong is also 50m.
We collected thin sections from it at depths of 24m,42m and 48m, and labeled them as JL-C24,JL-C42, and JL-C48. Additionally, major element analysis was conducted.
The data of Chihsingshan background come from Central Geological Survey,MOEA 1993；1994.
The data of east of explosive crater come from Lai's unpublished data.

Location	Drilling depth	Thin-section depth	Major element depth
Yachi	50m	11m、21m 30m、50m	11m 30m、50m
Jin Lu Tian Gong	50m	24m 42m、48m	24m 42m、48m

Tab.1 The drilling core depth, thin-section preparation depth, and depth of major element analysis for Yachi and Jin Lu Tian Gong are summarized in this table.

Analytical methods

1.Point counting

We cover the Thin-section with 400 to 600 points.
Then, for each of these points, the underlying mineral is identified.
Last , we derive the phenocryst proportion and the mineral composition.

Thin-section making

Step 1. Cutting a slab with saw machine
Step 2. Initial lapping of the slab
Step 3. Glass slide is added.
Step4. Slab is sectioned
Step 5. Final lapping
Step6. Counting

2.Major element analysis

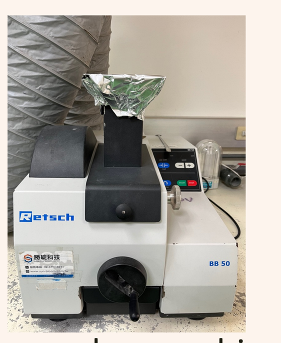
The major elements in rocks, referred to as rock-forming elements, are those whose concentrations exceed 1% by weight in the compositions. These elements are typically expressed in the form of oxides and include SiO_2, TiO_2, Al_2O_3, tFe_2O_3, MnO, MgO, CaO, Na_2O, K_2O, and P_2O_5.
The weight percentage values of these major elements can be used for rock classification.

Sample preparation for major element analysis

Step 1. Cutting cubics with saw machine
Step 2. Washing and drying
Step 3. Crushing and milling.
Step 4. Drying process
Step 5. Do the L.O.I experiment
Step 6. Make fused beads
Step 7. Do XRF analysis with XRF spectrometer


Saw machine


Fused beads


Jaw crusher machine


Planetary ball mills


XRF spectrometer

Results & Conclusion

1.The groundmass & phenocrysts

On the eastern side, the samples have approximately 54% phenocrysts. Compared to Yachi and Jin Lu Tian Gong, the samples from the eastern side have a more consistent phenocryst-to-groundmass ratio and a higher proportion of phenocrysts.

2.The mineral composition

At The Yachi , the mineral composition consists of hornblende, plagioclase, pyroxene, clinopyroxene, titanium iron oxide.The mineral composition of Jin Lu Tian Gong is similar to that of the Yachi. However Jin Lu Tian Gong with a higher proportion of titanium iron oxide compared to Yachi. In summary, there is no distinct vertical variation in lithological composition within the two cores.

3.Mineral with cracked

The minerals fracture due to the pressure reduction as magma ascends. As the fig.1 and fig.2 show, there were observed in samples from Yachi and Jin Lu Tian Gong.

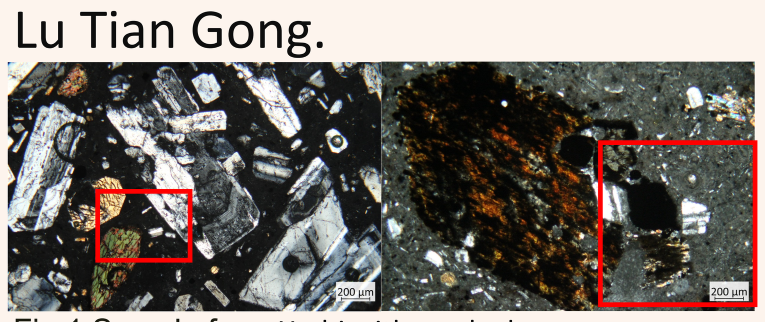


Fig.1 Sample from Yachi with cracked

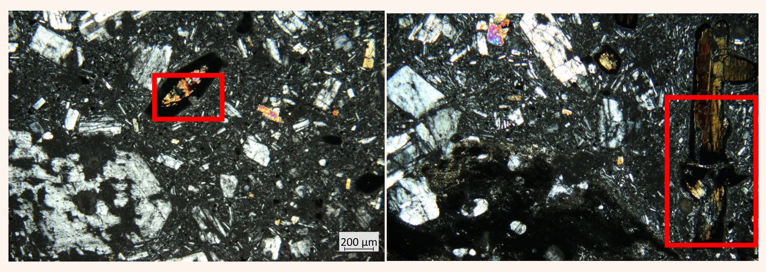


Fig.2 Sample from Jin Lu Tian Gong with cracked

4.Resorption zone

There are three causes of Resorption zone: decompress、temperature increase、and incorporation of magmas with different compositions. These lead to plagioclase crystals with a vesicular structure. As the fig.3 and fig.4 show, there were observed in samples from Yachi and Jin Lu Tian Gong.

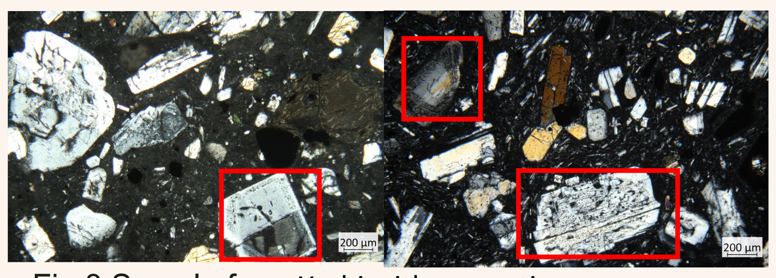


Fig.3 Sample from Yachi with resorption zone

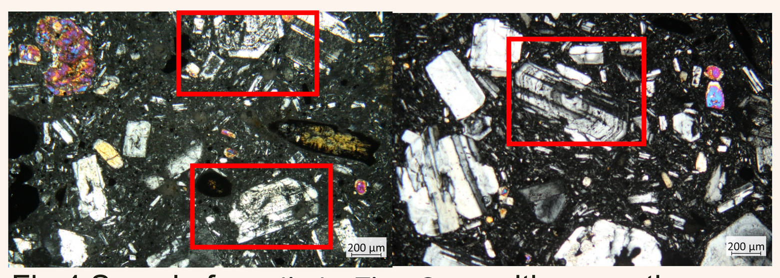


Fig.4 Sample from Jin Lu Tian Gong with resorption zone

5. Amphibole Breakdown Reactions Rims

There are two types of amphibole reaction products which are black-Rimmed type and gabbroic type formed as a result of dehydration.As the fig.5 andfig.6 show, there were observed in samples from Yachi and Jin Lu Tian Gong.

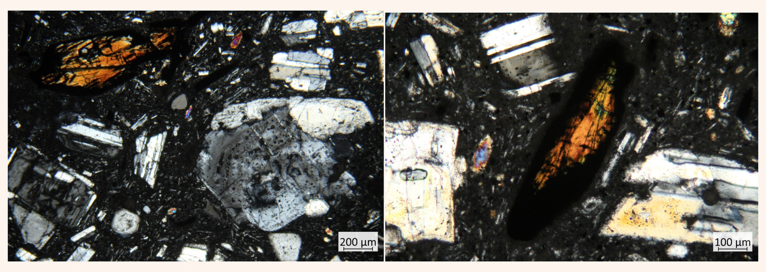


Fig.5 Sample from Yachi and Jin Lu Tian Gong with black-Rimmed type

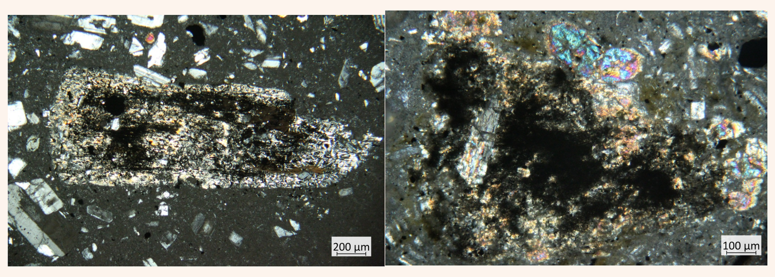


Fig.6 Sample from Yachi and Jin Lu Tian Gong with gabbroic type

6. The condiction of major element

According to the TAS diagram classification, the Chihsingshan volcanic fields are categorized as andesite and basalt andesite. On the other hand, the explosive crater on the eastern and western sides are predominantly composed of andesite.
They are categorized as part of the calcium-alkaline series,but the explosive craters on the eastern and western sides have medium potassium content.

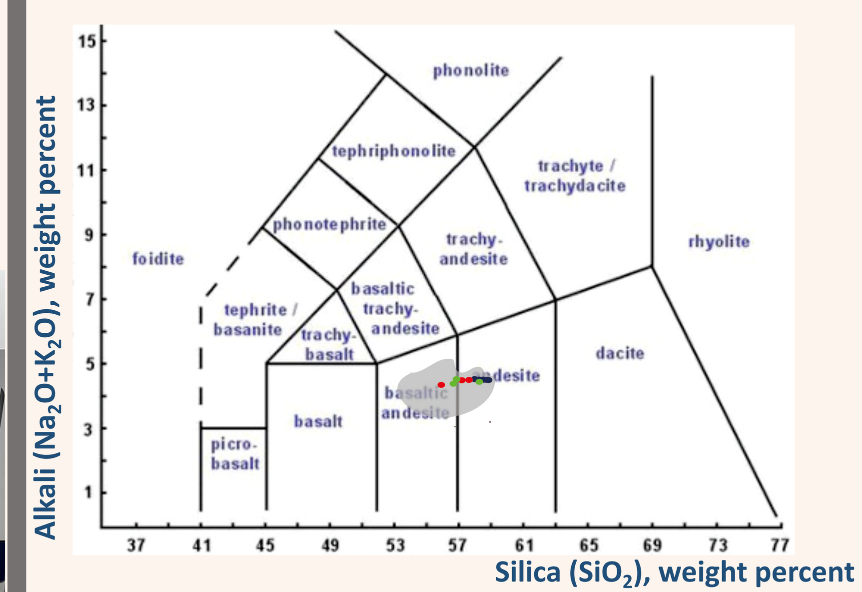


Fig.7 The TAS diagram classification of Chihsingshan volcanic fields

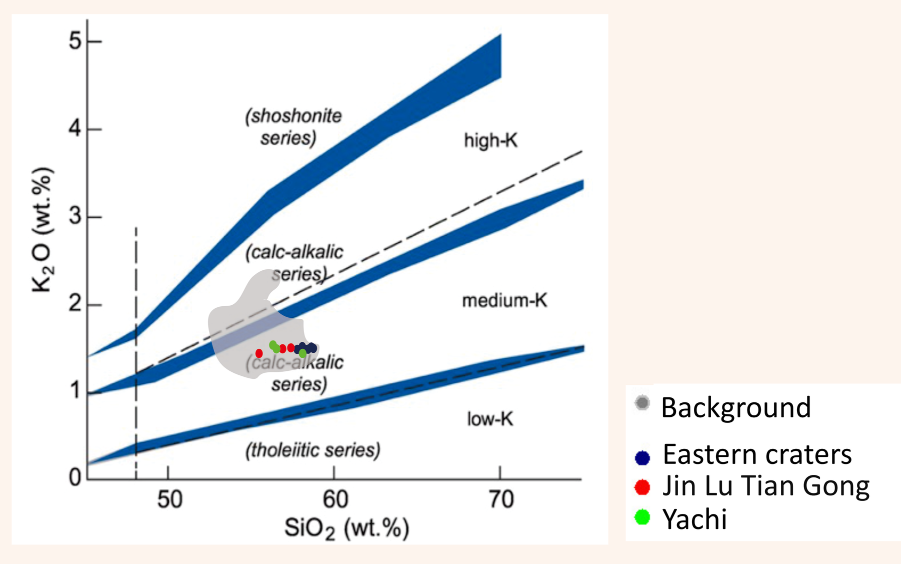


Fig.8 The diagram of K_2O versus SiO_2 of Chihsingshan volcanic field