國立臺灣大學 103 學年度碩士班招生考試試題

(礦物部分共 50 分)

一、 【解釋名詞，每題 5 分，共 20 分】

(1) Exsolution (2) Miller indices

(3) Muscovite (4) Tetragonal system

二、 【簡答題，共 20 分】：下列是摘自礦物學課本對 *Epidote* 礦物之描述性資料，請在詳細閱讀後按照題號簡單且完整的回答本題的 10 個小題。(照抄英文得零分)

EPIDOTE—$Ca_2(Al,Fe)Al_2O(SiO_4)(Si_2O_7)(OH)$

Crystallography. Monoclinic; $2/m$. Crystals are usually elongated parallel to *b* with a prominent development of the faces of the {010} zone, giving them a prismatic aspect. Striated parallel to *b*. Twinning on {100} common. Usually coarse to fine granular; also fibrous.

$P2_1/m$; $a = 8.98$, $b = 5.64$, $c = 10.22$ Å, $\beta = 115°24'$; $Z = 2$. *ds*: 5.02(4), 2.90(10), 2.86(6), 2.53(6), 2.40(7).

Physical Properties. *Cleavage* {001} perfect and {100} imperfect. H 6–7. G 3.25–3.45. *Luster* vitreous. *Color* epidote: pistachio-green to yellowish-green to black. Transparent to translucent. *Optics*: Refractive indices and birefringence increase with iron content. (−): $\alpha = 1.715$–1.751, $\beta = 1.725$–1.784, $\gamma = 1.734$–1.797; $2V = 64°$–$90°$; $Y = b$, $X \wedge c = 1°$ to $-5°$; $r > v$. Absorption $Y > Z > X$. Transparent crystals may show strong absorption in ordinary light.

Composition and Structure. A complete solid solution series extends from clinozoisite ($Al:Fe^{3+} = 3:0$) to epidote ($Al:Fe^{3+} = 2:1$). *Piemontite*, $Ca_2Mn^{3+}Al_2O(SiO_4)(Si_2O_7)(OH)$, is isostructural with epidote and clinozoisite but contains mainly Mn^{3+} instead of Fe^{3+} or Al^{3+} in the Al site outside the chains of the epidote structure.

Diagnostic Features. Epidote is characterized by its pistachio green color and one perfect cleavage. Piemontite by its pink-rose color and cleavage.

Use. Sometimes cut as a gem.

Occurrence. Epidote forms under conditions of regional metamorphism of the epidote-amphibolite facies. Characteristic associations of actinolite–albite–epidote–chlorite occur in the upper part of the greenschist facies. Epidote forms also during retrograde metamorphism and forms as a reaction product of plagioclase, pyroxene, and amphibole. Epidote is common in metamorphosed limestones with calcium-rich garnets, diopside, vesuvianite, and calcite. *Epidotization* is a low-temperature alteration process and is found in veins and joint fillings in granitic rocks.

Epidote is a widespread mineral in igneous and metamorphic rocks. Notable localities for its occurrence in fine crystals are Knappenwand, Untersulzbachthal, Salzburg, Austria; Bourg d'Oisans, Isère, France; and the Ala Valley and Traversella, Piemonte, Italy. In the United States, found at Riverside, California, and on Prince of Wales Island, Alaska.

Name. Epidote from the Greek word meaning *increase*, because the base of the vertical prism has one side longer than the other. Zoisite was named after Baron von Zois and piemontite after the locality, Piemonte, Italy.

Similar Species. *Zoisite* is an orthorhombic polymorph (space group *Pnma*) of clinozoisite. It is similar in appearance and occurrence to clinozoisite but is less common. In 1967 gem quality, blue-colored crystals were found in Tanzania. This variety is known as *tanzanite*.

1. *Epidote* 的中文礦物名稱是什麼？*Epidote* 是因為什麼而得名？
2. 如何鑑定 *Epidote*？
3. *Epidote* 的結晶構造屬於哪一個晶系？哪一個晶族？哪一個空間群？
4. *Epidote* 與哪一種礦物形成完全固溶體？成分有何差異？
5. *Epidote* 具有什麼解理？硬度是多少？
6. *Epidote* 的比重是多少？以中文來說是什麼光澤？
7. *Epidote* 的結晶構造（晶胞）中，最長的軸是哪個軸？一個晶胞中有多少個原子？
8. *Epidote* 在變質石灰岩中常會與哪幾種礦物共生？
9. *Epidote* 的光學性質具有幾個光軸？透明晶體在正常光線下具有何種光學特性？
10. 較近代才發現的藍色變異 *epidote* 晶體是種重要的寶石，其名稱是什麼？其名稱是根據什麼命名的？

見背面

三、 從 19 世紀中以來，礦物都按照其化學成分來分類。常按照礦物所含有的主要陰離子或陰離子團來分成許多 classes（例如：碳酸鹽類礦物）。(1)請**列出（除了碳酸鹽類）五類礦物 classes 的名稱與其陰離子成分**。【5 分】 (2) 請各舉一個屬於上小題所列五種類礦物的「常見礦物」名稱與成分。 【5 分】

(岩石部分共 50 分)

一、 如何定義火山岩?詳述火山噴發產物和成因，及台灣地區火山岩的分布和形成機制。【15 分】

二、 何謂變質岩的 P-T-t?請以台灣為例子說明如何利用 P-T-t 來闡述造山帶的抬升演化史。【15 分】

三、 【解釋名詞，每題 5 分，共 20 分】:

(1) Fractional Crystallization

(2) Authigenic Minerals

(3) Sedimentary Provenance

(4) Protolith

試題隨卷繳回