金瓜石區域次生螢光碳酸鹽礦物之成因、特性與應用潛力分析

螢光礦物除了在地質學與環境科學上具有重要性外，在材料科學與高科技產業中亦扮演關鍵角色。某些螢光礦物所含的微量元素，如稀土元素和過渡金屬，對於超導體與半導體材料的發展極為重要。例如，特定的螢光礦物可能含有對高溫超導體具有增強效應的元素，而半導體產業中使用的螢光材料亦可應用於發光二極體（LED）與雷射技術。因此，研究螢光礦物的成分與特性，除了能加深對地球化學過程的理解外，也可能為新材料開發提供參考。

金瓜石地區位於台灣東北部，以其豐富的礦產資源聞名，過去主要以金、銀、銅等礦產開採為主。然而，近年來該區域的礦物學研究逐漸關注其多樣性的次生礦物，其中部分碳酸鹽類與硫酸鹽類礦物具有螢光特性。此外，其區域地下水中含銅離子可能促使次生碳酸鹽類礦物形成，導致其礦物組成更加複雜，並可能影響其螢光性質。透過螢光特性分析，不僅可增進對礦物組成與結構的理解，亦可應用於礦物探勘與地質監測。因此，本研究旨在對金瓜石區域之螢光礦物進行界定，並分析其物理化學性質，以探討其成因與環境意義。

本研究的主要目標包括界定金瓜石區域內具有螢光性的次生碳酸鹽礦物種類，選取金瓜石主要礦化帶及舊礦坑區域進行系統性樣品採集，並透過偏光顯微鏡與 XRF 測定樣品之元素組，進行礦物初步鑑定。並利用拉曼光譜分析螢光礦物之發光機制。預期建立金瓜石區域螢光礦物目錄。此外，將探討螢光礦物的形成環境及其與區域地質背景的關係，特別是水中銅離子對碳酸鹽類螢光礦物組成與性質的影響，並評估其在礦產探勘及環境監測中的應用潛力。

本研究計畫預計為期兩個月，第一至三週進行文獻回顧與樣品採集，第四至第五週進行實驗室分析（XRD、XRF、拉曼光譜等），第六至第七週整理數據並探討螢光機制，最後一週進行成果整理與論文撰寫。

Analysis of the Origin, Characteristics, and Application Potential of Secondary Fluorescent Carbonate Minerals in the Jinguashih Area

Fluorescent minerals, in addition to their importance in geology and environmental science, play a crucial role in materials science and high-tech industries. Certain trace elements in fluorescent minerals, such as rare earth elements and transition metals, are vital for the development of superconductors and semiconductor materials. For example, specific fluorescent minerals may contain elements that enhance the effects of high-temperature superconductors, while fluorescent materials used in the semiconductor industry can also be applied in light-emitting diodes (LEDs) and laser technologies. Therefore, studying the composition and properties of fluorescent minerals not only deepens our understanding of geochemical processes but may also provide references for the development of new materials.

The Jinguashih area, located in the northeastern part of Taiwan, is renowned for its rich mineral resources, with past mining primarily focused on gold, silver, copper, and other ores. Providing copper ions in the region's groundwater may promote the formation of secondary carbonate minerals, complicating its mineral composition and potentially affecting its fluorescence properties. Through fluorescence property analysis, not only can we enhance our understanding of the mineral composition and structure, but it can also be applied in mineral exploration and geological monitoring.

This project aims to define the fluorescent minerals in the Jinguashih region and analyze their physicochemical properties to explore their origin and environmental significance.

The main objectives of this study include defining the types of secondary carbonate minerals with fluorescence in the study region, systematically collecting samples from the main mineralization belts and old mining pit areas, and conducting preliminary mineral identification through polarized light microscopy and XRF analysis of the elemental composition. Additionally, Raman spectroscopy will be used to analyze the luminescence mechanism of fluorescent minerals. The goal is to create a catalog of fluorescent minerals in the region. Furthermore, the study will explore the formation environment of fluorescent minerals and their relationship to the regional geological background, particularly the impact of copper ions in the water on the composition and properties of carbonate fluorescent minerals, and evaluate their potential applications in mineral exploration and environmental monitoring.

This research project is expected to take two months. The first to third weeks will focus on literature review and sample collection, the fourth to fifth weeks on laboratory analysis (XRD, XRF, Raman spectroscopy, etc.), the sixth to seventh weeks on data organization and exploration of the fluorescence mechanism, and the final week will be dedicated to results compilation and thesis writing.