

台灣西部卵礫石地層之坡度影響因子及其地質材料特性

The influence on slope grade and geomaterial properties of gravel formation in western Taiwan

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摘要

本研究即嘗試利用卵礫石層的組成、形狀、排列方向等因子，來探討卵礫石地層所對應坡度的影響，並將台灣西部卵礫石地層的特性，做一整合探討與比較，觀察其不同區域間的差異性，以及這些差異是否對於坡度具有特別的影響。

從雲林古坑、南投九九峰、苗栗火炎山及西北部台地地區之卵礫石地層的調查中可以發現，各研究區域之卵礫石的排列方向與坡面傾向方向一致時，當傾向夾角越小，坡度有下降的趨勢；反之，當傾向夾角越大時，坡度會呈現上升的趨勢，其相關係數值都達到了 0.85 以上。在各區域中坡體的傾向並無明顯的規律性，僅有卵礫石的排列方向較具規則，其中以火炎山、九九峰及雲林古坑三個地區卵礫石的傾向集中於東南方向較為顯著。在坡度分佈方面，各研究區域之間並沒有太大的差別，主要分佈於 60°至 75°之間。大體而言，桃園台地的坡度較為平緩，而火炎山以及雲林古坑地區，則顯得較為陡峭。

在形狀方面，各研究區域皆以碟狀與球狀的卵礫石含量較多，佔了 65%以上。另外在卵礫石形狀與坡度的關係方面，當碟狀與板狀的卵礫石含量增多時，坡度有增加的趨勢；當球狀卵礫石含量增多時，坡度則有下降的趨勢，呈現負相關的關係，其相關係數皆達到了 0.5 以上；而柱狀卵礫石含量與坡度間則較無明顯的關係性。各研究區域中，則以九九峰地區之卵礫石形狀相對於坡度的關係性較為良好。

在地質材料性質方面，各研究地區之基質或卵礫石之自然物理性質並無明顯的差別。各區域皆以粗顆粒的卵礫石為主，大於 2mm 以上的卵礫石顆粒分佈均超過 70%以上，為屬於級配不良的礫石(GP)分類。此外當卵礫石層中大於 2mm 的粗顆粒含量增多時，各區域中的坡度皆呈現正相關的上升趨勢，其相關係數值皆高於 0.6 以上。各研究區域之卵礫石層主要由砂岩質及石英岩質的卵礫石所構成，其強度大抵都分佈在 900 kg/cm² 以上，為屬於強岩(R4)及甚強岩(R5)的分級。經由古水流的方向顯示，林口台地之古水流呈扇狀的分佈，顯示當時為一扇洲的沉積環境；在桃園、大肚台地地區，古水流的方向皆指向西方；而火炎山、九九峰以及雲林古坑地區，古水流的方向則是由東南向西北流動；大抵而言，整個台灣西部的古水流流向，均由東邊往西方流動，顯示這些卵礫石的來源可能為東邊的雪山及脊梁山脈，經由水流的搬運於西部地區沉積，形成現今的卵礫石地層。至於基質強度方面，林口、桃園等台地之台地礫石層，由於地層年代較年輕，加上受風化淋餘作用等影響，基質強度僅介於 2~80 kg/cm²；而火炎山、九九峰及雲林古坑地區之更新世頭料山礫石層，經過長時間的壓密、膠結等作用，基質強度則介於 100~250 kg/cm² 之間，已達弱岩的分類標準(ISRM)。

關鍵詞：卵礫石

Abstract

In-situ investigation of gravel formation in Yunlin Gukeng, Nantou 99 Peaks, Miaoli Hou Yen Shan and northwestern terrace reveals that when the dip directions of the gravel orientation and slope surface are consistent, the intersected angle of dip direction has smaller value and the slope grade appears to decrease. In contrast, when the intersected angle has larger value, the slope grade appears to increase. All the correlation coefficient is more than 0.85. The dip direction of slope surface in each area is random. However, the gravel orientation is uniform and obviously centered upon southeastern direction in Hou Yen Shan, 99 Peaks and Gukeng. The slope grade has relatively little difference in all study areas. All ranges between 60°~75°. In general, the slope grade in Taoyuan terrace is smooth, while it appears steeper in Hou Yen Shan and Gukeng.

The gravel proportion of disc and sphere shapes are more than 65% in composition. The slope grade will increase when the gravel proportion of disc and blade shapes increases in the composition. While the sphere shape proportion of the gravel increases, the slope grade will decrease. Both correlation coefficients are more than 0.5 in all study areas. However, the rod shape has no obvious correlation with the slope grade. Among the study areas, only the gravel shape in 99 Peaks has good correlation with slope grade.

Having compared geomaterial properties, there is no much difference in matrix or gravel of the study areas. The main composition is the gravel particles with a size in excess of 2mm which make up more than 70% of the study areas, classified as poorly-graded gravel (GP). As the proportion of the gravel particles over 2mm increases, the slope grade will increase. The positive correlation coefficient is more than 0.6. The major lithological composition of gravel in all study areas is sandstone and metamorphic sandstone which strength is generally rated at 900 kg/cm², called "Strong Rock" (R4) and "Very Strong Rock" (R5). In general, the direction of paleocurrents in the western part of Taiwan is from the east towards the west. It reveals that the original source of the gravel might be from the eastern mountains and then transported downstream to the west and formed the present gravel formation. Regarding the matrix strength in Linkou and Taoyuan terrace, it ranges only from 2 to 80 kg/cm² due to younger age and weathering effect. On the other hand, the matrix strength in Hou Yen Shan, 99 Peaks and Gukeng ranges from 100 to 250kg/cm² after being consolidated for a long time, classified as "weak Rock" (ISRM).