Comparison of the disturbance of soil physical quality indices between different underground mining stages in semi-arid regions of western China

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April 28, 2020

Abstract

Based on soil sampling, lab experiment and support resistance monitoring, the disturbance of soil physical quality indices between different underground mining stages of No 52303 working face was studied in semi-arid region of western China. Soil sampling was conducted in same locations before and after mining in 2014. This study proved that soil water content, soil cohesion and soil porosity were greatly decreased, while bulk density and dry density were increased by coal mining. In comparison, coal mining had slight effect on organic matter, internal fraction angle, and D1 and D2 percent. Underground pressure monitoring showed that P1 during stage 2 was significantly greater than that during stage 1, indicating the large difference of pressure characteristics in tail areas of working face between two stages. Both soil water content and soil cohesion were decreased during two stages in two sites. Soil cohesion was strongly correlated to soil water content, and D1 and D2 percent in 2013 and 2014. Coal mining subsidence increased the cumulative probability to reach the same value of soil water content and soil cohesion. The cover depth produced different elastic and plastic zone widths between sites by theoretical model calculation, consistent with the support resistances in tail areas of working face. Higher pressure might cause a more serious destructive rock-soil body and a larger groundwater level decrease. The dryer and more serious erosive soil column induced by coal mining is a non negligible matter for the semi-arid region.

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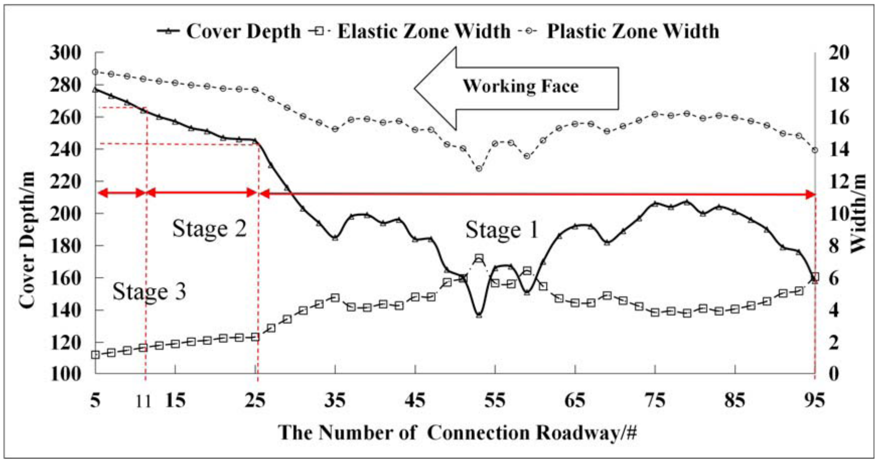


Figue 1: The relationships between cover depth and elastic and plastic zone widths for longwall No. 52303 during different strata behaviour stages

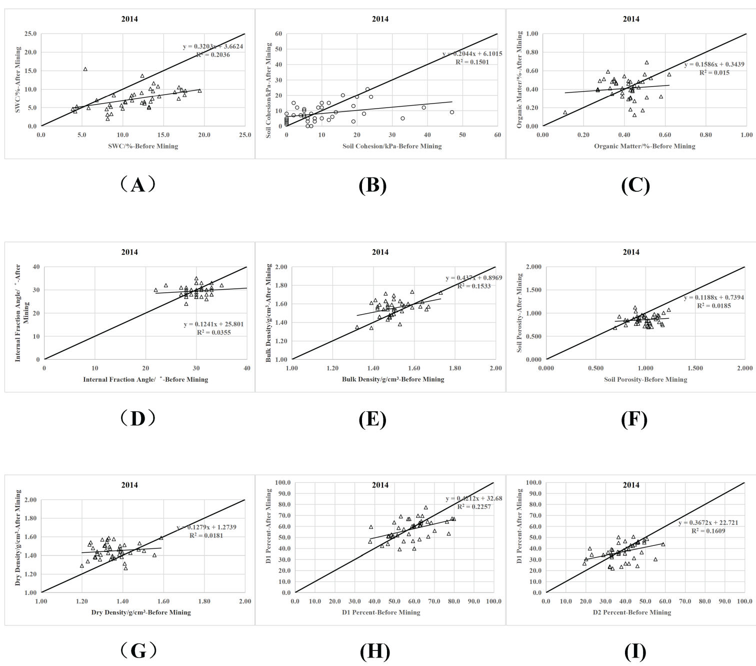


Figure 2: The comparisons of soil physical quality indices before and after mining during stage 2 in 2014

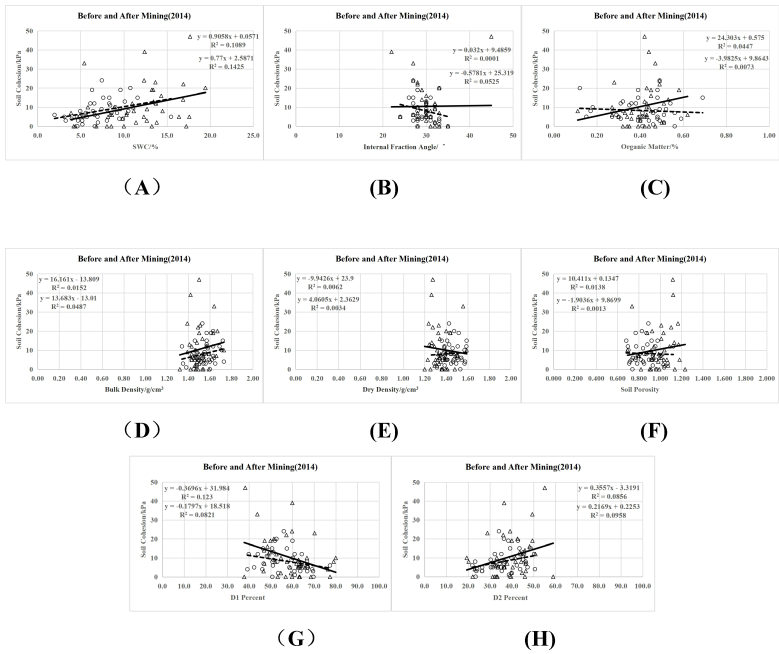


Figure 3: The relationships between SC and other indices before and after mining during stage 2 in 2014

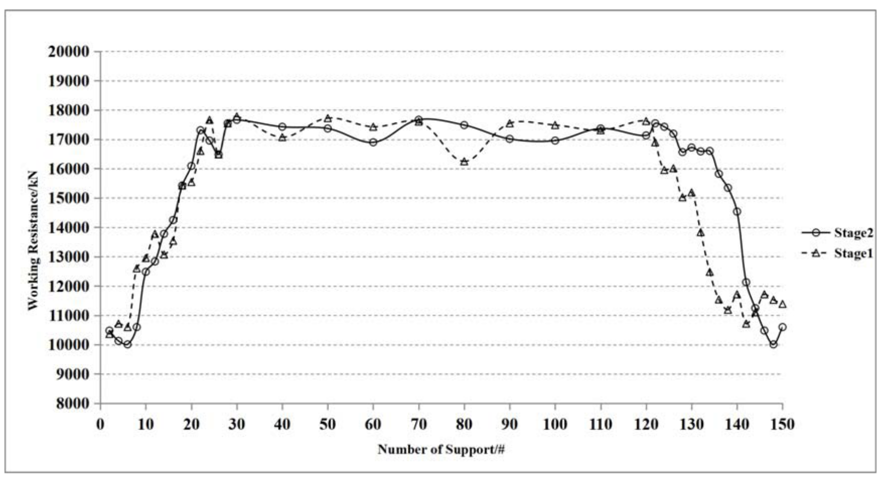
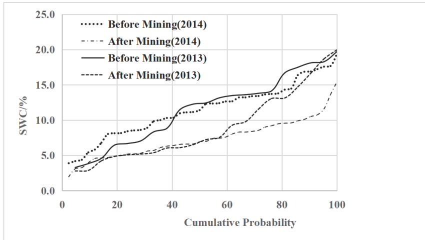
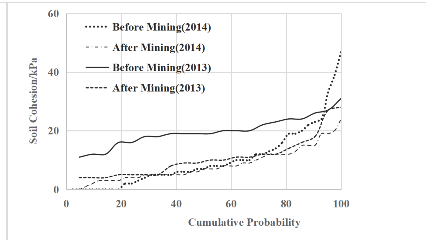


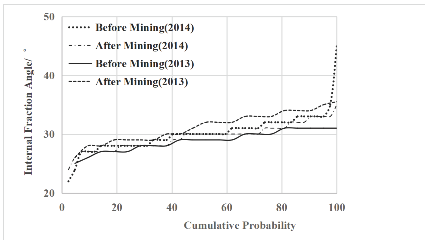
Figure 4: The whole comparison of support resistances between stage 1 and 2 (Zhu et al. 2017)



(A)



(B)



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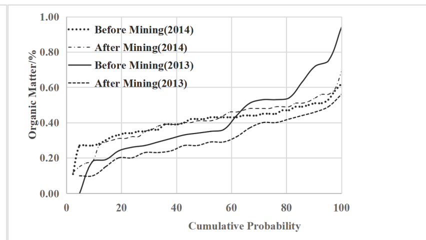

(D)

Figure 5: The cumulative probability of soil cohesion, SWC, internal fraction angle, and organic matter before and after mining in 2013 and 2014