Using Overburden Field Clues

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Field clues mean simple observations and measurements that provide useful information about overburden properties. Anything you can see, feel, hear, taste or smell may serve as a clue if it is calibrated against behavior of rock and soil materials. Since suggested clues have been listed elsewhere, this discussion will merely emphasize or add some points that deserve special attention.

The use of field clues should be a continuous process. It may give the best answer to questions about spacings needed for sampling and analysis of overburden columns. When a mining operation is planned following characterization of an overburden column, the assumption is that the overburden throughout the area is similar to that of the column. Adding more and more columns to be analyzed doesn't It necessarily improve precision. No two columns will be identical and minute differences may detract from major features that should guide decisions about placement.

The high chroma (brown) weathered zone, for example, follows a wavy or irregular boundary line and not some fixed depth or elevation. Carbonate-rich zones often thicken or thin and may be identifiable by nodular bands, white coatings on fracture planes, or by fizz testing with acid. Pyritic layers may thicken or fade out, together with carboliths identified by changes in darkness of powdered color. Sandstone stability may vary from loose sand to cemented quartzite, the latter being confirmed by the sharp ring of a blow with a metal hammer.

These and other observations can indicate quickly where overburden changes occur that might call for additional selected confirmatory analyses or adjustments in placement. These adjustments could involve taking a thicker or a thinner cut; making some revision in blasting; special liming; or special handling to take advantage of desirable properties or to eliminate a hazard.

Skill in noting and interpreting field clues should be cultivated, both by company employees and by regulatory inspectors. Both could profit from collecting selected samples for testing, to determine whether or not their observations and interpretations are correct. Many opportunities are being missed because of simple failure to check for free carbonates in each different overburden layer. Likewise with acid-forming layers and materials. You can spot these by smell, by taste, and by observing wet and oily-looking spots on new minesoils. White salt deposits on questionable materials, are often incorrectly identified because they are not properly checked, with acid (for carbonates) and by smell and taste (to distinguish acid aluminum compounds from neutral gypsum and epsomite salts).

Every person interested in reclamation in the field should have his eyes well trained and calibrated with Munsel color chips. His fingers should be calibrated to rock and soil textures. The ring of a tough sandstone or limestone under a hammer blow should contrast with the dull thud of mudstones and other weakly cemented rocks. A carbon-rich rock which darkens the fingers should contrast immediately with gray materials containing no oxidized iron. Yet, it is common to hear rocks called black or "carb" rocks which are nearer to white in powder form than black and are essentially carbon-free.

Regarding familiar minerals, without problems from true gold we are still confusing pyritic fool's gold with micaceous fool's gold and with flakes or films of yellowboy.

Other useful clues include survival and growth of particular volunteer or seeded plants. But this is a major subject that can't be adequately treated here. Let it suffice to say that careful attention to plant performance on field sites, especially when calibrated with chemical tests, can contribute to mining and reclamation success. However, serious mistakes can be made if you reach conclusions too quickly or without a reasonably broad base of observations.

Notes on Overburden Sampling

The best way to approach sampling below the soil is to go immediately to the coal that is to be mined. This assumes that an exploration core or a complete highwall exposure is available. In either case a sample should be taken representing 12 inches (30 cm) of rock immediately above the coal; and another sample representing 12 inches (30 cm) immediately below the coal. These 2 samples often, but no always, represent maximum sulphur percentages in the overburden column.

Next, the entire rock column should be examined in terms of observable rock or earth properties, from one foot (30 cm) above the coal, to the bottom of the soil profile as defined. This examination will result in separation of the column into rock types based on their properties. Any layer thinner than 5 inches (12 cm) should ordinarily be considered as transitional between adjacent thicker strata, unless the thin unit affords contrasting properties of special interest, in which case it should be sampled separately.

The rock units recognized for sampling will differ in color, texure, hardness, bedding, and degree of fracturing or disintegration. Colors are readily checked with Munsell color chips. Texture is estimated by eye and by feel. Hardness of fine textured rocks are checked with fingernail and knife, as well as by other common hardness standards if needed. The presence of carbonates is determined with 10% hydrochloric acid.

Having established the major rock units, appropriate samples are taken from each. With sandstone rock types at least one sample is taken to represent each 5 feet (150 cm) of thickness. With other rock types, as well as loess, drift and colluvium, one sample is taken for each 3 feet of thickness or less.

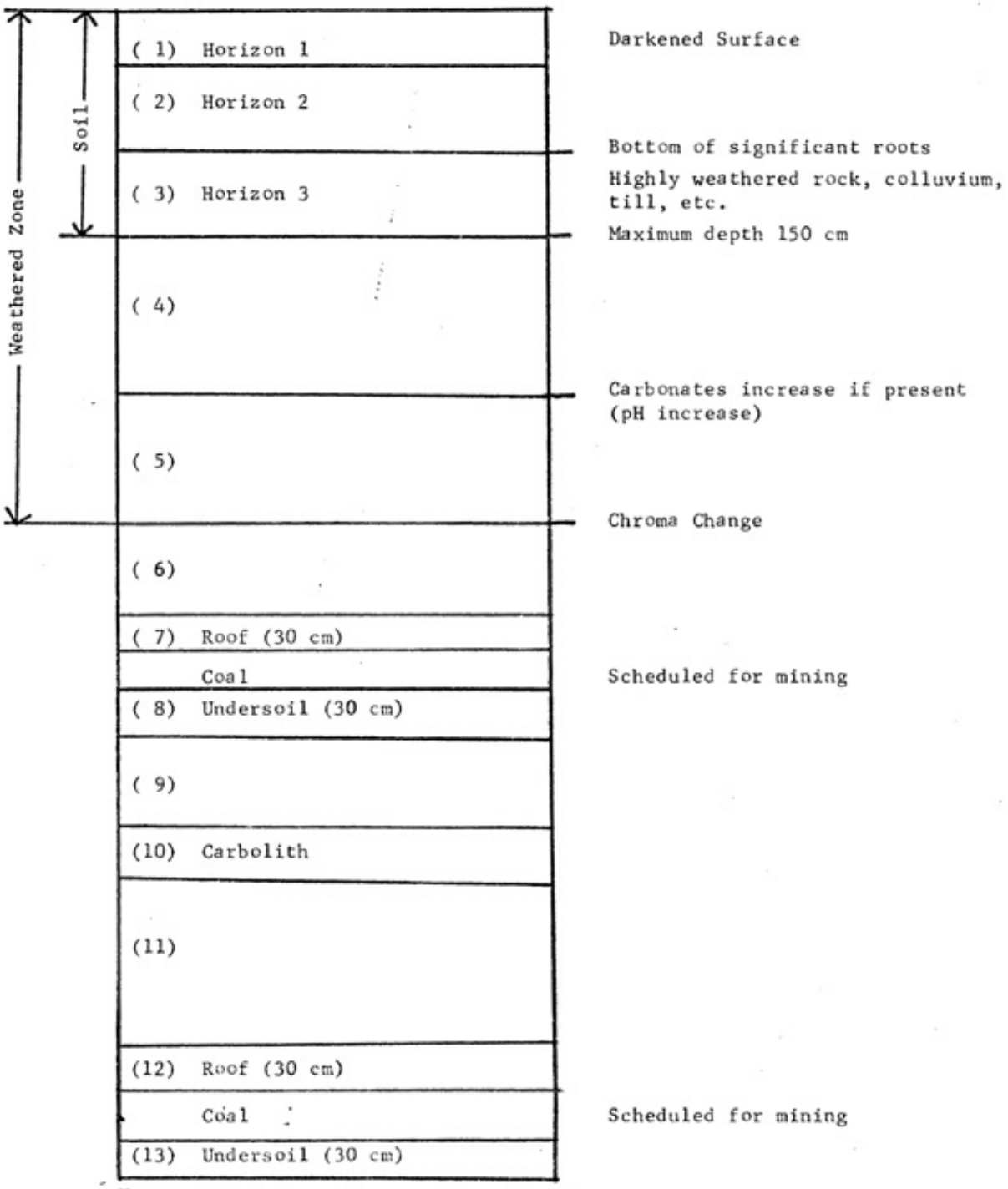
Sampling as outlined is simple. It requires no great theoretical competence in geology or pedology. It is aimed at sampling practical properties. Such sampling involves about one sample per 3 feet (90 cm).

If a person lacks confidence in sampling, he can reassure himself and others by initially

marking the entire core at one foot intervals and taking a 5 inch (12.5 cm) section from near the center of each foot. If, after this arbitrary method has been followed, certain successive samples appear similar, it would be satisfactory to combine them saving only part of each original sample. Blast hole drillings offers a speedy and easy method of collecting overburden samples. The rock chips expelled from the hole are caught at one foot intervals. Successive samples may be combined after rock units have been determined.

In referring to overburden it should be understood that the soil profile is included as well as rock or soil under the coal. Also, rock unit refers to any layer in the overburden which differs in properties that may influence the handling of the material or the quality of resulting minesoil or water, regardless of whether these layers are considered to be different geologic strata.

SAMPLING DIAGRAM



Note: The numbers in parentheses indicate the overburden samples that would be taken for laboratory analysis.

Acid Base Accounting

I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
					$CaCO_3$ EQUIVALENT TONS/1000 TONS OF MATERIAL						
SAMPLE NUMBER	DEPTH (FEET)	ROCK TYPE	FIZ	COLOR	%S	MAX. FROM %S	AMT. PRESENT	MAX. NEEDED (pH7)	EXCESS	H_2O SLAKING	PASTE pH
Start at the soil surface and number consecutively to undersoil	Record in feet or meters, to one decimal only.	Use simple standardized terms, as defined	This should be checked carefully on 60 mesh powder with good light	Use dry, 60 mesh material, good light and Munsel color book.	Leco-type furnace or equivalent preferred. Record to 2 decimals. Peroxide methods can be used when calibrated carefully.	This is calculated by multiplication by 31.25, giving maximum if all pyrite. Express in calcium carbonate equivalent in parts per thousand.	Determined by the standardized N.P. Method. Positive numbers mean alkalinity. Numbers from zero to negative 5 are largely exchangeable and nonleachable. Negative numbers bigger than 5 often mean sulfuric acid.	This includes the maximum acid from sulfur, assuming that all sulfur is pyrite (the worst possible case), plus "amount present" if negative; or minus "amount present" if the N.P. is positive. Record here if resultant is acid.	If the resultant from columns VI and VII is alkaline, record here as excess or reserve of alkalinity.	If fragments of uncrushed overburden are available, a simple mild slaking test (See Sobek et al 1978 Manual) will indicate immeidate physical weathering reaction if exposed to the weather.	Paste pH is preferred because the electrodes are in intimate contact with rock or soil. pH below 4.0 is arbitrarily considered toxic because this is where reclamation problems become acute. Clays can give pH as low as 4.0.