

# **CARDI Soil and Water Science**

## **Technical Note No. 04**

### **Ou Reang Ov**

#### **A New Soil Group for the Cambodian Agronomic Soil Classification**

##### **Group 11 - Ou Reang Ov**

Only the rice soils of Cambodia have been described in detail (White et al. 1997). The naming and identification of the Rice Soil groups has become familiar to agronomists, extension officers and farmers in Cambodia due to their common usage and the many training programmes conducted on their identification and properties (Heer et al. 1999). However, the Rice Soil Manual does not describe all the soils of Cambodia (White et al. 1997). The key for identification of rice soils allows for undefined and unclassified soils. Most of the non-rice soils of Cambodia are likely to fall into this category. Increased emphasis on crop diversification and upland farming has created a need for more detailed information on the soils in these upland areas. This is one of a series of Notes describing new Soil groups on upland soils that are proposed for inclusion into the Cambodian Agronomic Soil Classification (CASC). The Ou Reang Ov Soil group has been recognised and described by the CARDI Soil and Water Research program under ACIAR Project, “Assessing land suitability for crop diversification in Cambodia and Australia”. The purpose of this note is to assist agronomists, extension officers and farmers to recognise the Ou Reang Ov Soil group, to outline its main limiting factors, soil management requirements, and potential for land use.

It is important to note that for upland soils, profile descriptions will need to be deeper than the 20 cm generally used for rice soils, because of the greater root depth of crops on upland soils, and their greater reliance on sub-soil stored water and nutrients.

This Research Note describes the appearance and properties of the Ou Reang Ov soil group to help agronomists to recognise the soil in the field and to guide management for improved productivity. A more detailed explanation of its taxonomy, pedogenesis and soil chemical properties can be found in Hin et al. (2005).

##### **Group Concept**

A soil occurring on the sides of hills or mountains with a dark brown or very dark brown topsoil that has a clayey or loamy texture and a dark brown to dark red subsoil with a clayey or loamy texture that extends deeper than 50 cm. Abundant gravel is found in the soil.

##### **Occurrence**

The Ou Reang Ov soil occurs in similar locations and generally in close proximity to Labansiek and Kompong Siem Soil groups in the basaltic landscapes of eastern Cambodia. All three soils occur in eastern Kampong Thom province (they were

observed as far west as Santuk district), across much of Kampong Cham province (except where the Mekong River and its recent and ancient floodplain occurs in the province) and into parts of Kratie province.

It is commonly found in association with the Labansiek and Kompong Siem soils on the hills that rise 60-200 m above the level of the old alluvial plain (Fig. 1). The Ou Reang Ov soil occupies the mid slopes of these flat-topped hills while the Labansiek soil occupies the hill tops and upper slopes and the Kampong Siem soil occupies the lower slopes and valley floors.

The broad basaltic upland is more or less undulating on top, limiting erosion and allowing for the development of deeply weathered red structured clays (Labansiek, non petroferic phase). The side-slopes of the upland are generally much steeper and dissected leading to generally shallower soils and rock outcrop/surface stones and boulders. The basaltic upland is built up of more than one flow (with possible differences in chemical composition) (Rasmussen and Bradford 1977) which may contribute to the occurrence of different soils on the top of the uplands versus the steeper side slopes. However, the relationship between rock composition in basaltic lava flows and soil development has not been tested. Small groundwater seepage areas are common in this landscape (Ovens 2005).

The soils associated with the side-slopes are generally brown and clayey, and may contain significant amounts of iron oxide-rich (i.e. ferruginous) gravels and partly weathered basaltic rock fragments. There is no suitable group for these soils in the Rice Soils of Cambodia, and the new *Ou Reang Ov* Soil Group is proposed.

The lower colluvial slopes and adjoining plain are influenced by the basaltic parent material, and characterised by deep dark cracking clay soils (Kompong Siem). These clays may contain basalt floaters in the profiles near the hills, but this becomes less common with distance from the basaltic rises. A schematic representation of the topographic relationships between Labansiek, Ou Reang Ov and Kompong Siem Soil Groups is shown in Figure 2.

Detailed soil profiles for this soil have been made at the following locations and the full profile description plus soil analysis results are available in the Cambodia Soil database located at CARDI.

Site code	Eastings	Northings
ACIAR0011	556032	1310665
ACIAR0014	560347	1306195
ACIAR0017	563058	1306245
ACIAR0018	563268	1306525
ACIAR0029	555747	1307117

Note: Datum IND60 Zone 48

### **General Description**

The Ou Reang Ov Soil Group is a dark brown to very dark brown coloured soil with a high proportion of gravel. It is derived from weathering of basalt and is commonly found on mid to upper slopes of the hills. Its position in the landscape is above where the Kompong Siem soil is found (Fig. 3), and below the Labansiek soil. Currently,

only the gravelly phase of this soil is proposed. The basaltic geology is common on the hills of Kampong Thom, Kampong Cham and Kratie provinces. Ou Reang Ov soils are likely to be common in these provinces but the extent of it needs confirmation by more extensive field observations. Basaltic geology is also found in Ratanakiri and Mondolkiri (Workman 1972).

The profile is moderately deep (usually more than 1 metre) and contains abundant gravel.

The surface horizon is 12 to 18 cm deep, dark brown to very dark brown, clayey or loamy texture, with common fine gravel. The surface is generally hard when dry.

The sub-surface layers are dark brown to dark red, extend generally to 120 cm depth or more, have clay to loamy texture, and are characterised by abundant, medium to coarse size gravel (Fig. 3).

Colour in the surface can vary from dark grey and very dark brown to dark brown and dark red. Sub-soil is generally dark brown but can vary to reddish brown. Depth of the soil usually extends greater than 1 metre but is sometimes less than 60 cm and sits on top of weathered basalt rock. Gravel (mostly ferruginous in composition but varying to iron-manganese gravels) is a distinctive characteristic of the Ou Reang Ov Soil group. The surface has variable amounts of fine gravel (from none to many), but with depth extending to 90 or greater than 120 cm, gravel becomes medium to coarse in size and abundant. The profile shows very little mottling and does not form cracks. A few coarse fragments of basalt are sometimes present in the soil.

The Ou Reang Ov soils occur in association with the Labansiek and the Kampong Siem soils and may be confused with these soil groups. The Labansiek grades into the Ou Reang Ov soil and then the Ou Reang Ov grades into the Kampong Siem soil with the progression from the top of the basaltic hills to the valley floors. In areas where the soils grade into each other, it may be difficult to assign the soils to a Soil group, however, the following guidelines apply.

Ou Reang Ov Soil group is less reddish in colour than the Labansiek soil especially at the surface. It has medium sized blocky peds compared to the crumb<sup>1</sup> peds of Labansiek. There is more gravel in Ou Reang Ov soil than Labansiek soil. When using the CASC, the Ou Reang Ov Soil Group does not key to Labansiek Soil group due to the dark brown colour and the lack of stable granular structure.

Ou Reang Ov soil generally occurs higher in the landscape and on greater slopes than Kompong Siem Soil group. The fields where Ou Reang Ov Soil group occurs are almost always too well drained for flooded rice cultivation. Colour of the soil is more brownish than Kompong Siem in the surface and distinctly reddish brown in the sub-surface. It has a greater abundance of gravel than in Kompong Siem. It does not key to Kompong Siem due to its dark brown colour and also due to its non-cracking behaviour.

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<sup>1</sup> While the peds of Labansiek soils are described as crumb structure, more correctly they should be described as granular peds. The peds of Labansiek soil will hereafter be referred to as granular.

### **Profile description (See Fig. 4)**

#### *Surface*

Depth	18 cm
Texture	Clay
Color	Very dark brown (moist)
Mottles	Many fine brown or red hard nodules
Consistency	Hard when dry
Structure	Strong medium granular

#### *Sub soil*

Depth	18- 45 cm
Texture	Clay
Color	Dark brown to brown (moist)
Mottles	Abundant medium red to brown, hard nodules
Consistency	Friable moist consistence
Structure	Moderate medium granular

#### *B horizon*

Depth	45 – 120+ cm
Texture	Clay loam
Color	Brown
Mottles	Abundant medium red to brown hard nodules, fine pale red to brown mottles and soft blue to black mottles
Consistency	Friable moist consistence
Structure	Moderate fine angular blocky

#### Synonyms

ACIAR0011 was classified as Skeletal Phaeozem (FAO -ISRIC-ISSS 1998). By contrast, profiles recognised as Kompong Siem Soil group from nearby were classified as Gleyic Phaeozom. The more oxidised variation of the Ou Reang Ov Soil group (ACIAR0017) was provisionally classified as a Nitosol (i.e. related to the typical Labansiek Soil group) and the shallower profile (ACIAR0029) was provisionally classified as a Regosol. According to Croker (1962), this soil would probably be assigned to the Regur Great Soil Group.

#### Division into phases

No phases have yet been identified for the Ou Reang Ov Soil group.

#### Soil management

Ou Reang Ov soil is well drained throughout. The surface is prone to be hard when dry. Although the soil occurs on sloping land, due to high permeability and stable structure, it is not prone to water erosion. The sub-soil is generally friable and root penetration to 60 cm or deeper has been observed. The presence of abundant (40-80 % of soil volume), medium to coarse gravel in the sub-soil may limit soil water storage and make crops on this soil prone to drought. The soil appears to have naturally high extractable P levels. Sulfur supply in the surface soil may be limiting for early growth but as roots penetrate deeper they access greater available supplies. Other nutrients appear from soil analysis to be in adequate supply. A possible limiting

soil chemical factor for deep-rooted Al sensitive species is sub-soil Al toxicity. However, Al saturation increased to 40 % at only 45 cm depth and below on one site out of four, so the extent of Al toxicity limitation is probably not serious.

#### Fertility Capability Class

Only four soil profiles have been analysed in total, so the results should be treated with some caution. Soils are low in extractable N and have moderate to low organic matter levels. Extractable P and K levels range from moderate to high. Extractable S levels were low in the surface layers but increased at depth. Other elements were generally adequate, although sub-soil K was low in some profiles. Exchangeable Al is high in some profiles, particularly at > 20 cm depth.

Based on the Fertility Capability Classification (Sanchez et al. 2003), the Ou Reang Ov soil group is classified as a CCr<sup>++</sup>d. This indicates a clayey texture to at least 50 cm, dry soil conditions for > 60 days per year and abundant gravel. Some profiles also have the a<sup>-</sup> condition modifier on account of > 10 % Al saturation in the top 50 cm of the profile.

#### Land capability

Ou Reang Ov soils are generally too shallow for rubber plantations. Given the low yield of upland rice (<1 t/ha) and the sloping, elevated landforms on which the soil occurs, growing other field crops should be more economical than upland rice. Major limiting factors are low soil water storage, and possible Al toxicity in the sub-soil for sensitive crops. The soil appears to drain well and is not prone to soil erosion even on slopes, but nevertheless protection of the soil from water erosion should be practiced. Crop yields on this soil are generally inferior to those on Kompong Siem and Labansiek Soil groups when fertiliser is applied. However, farmers who generally use little or no fertiliser, rate Ou Reang Ov soil as more productive for crops than Labansiek or Kompong Siem soils. Acid tolerant crops like peanut, cassava may be more productive than soybean, maize, sesame and mung bean. Overall land capability for non-rice crops was rated as fair to good (Class 3 to 2), depending on low soil water storage and perhaps sub-soil pH.



**Fig. 1.** View of the basaltic landform in Ou Reang Ov district with characteristically flat-topped hills (background) that rise 60-80 m above the level of the old alluvial plain. Soils in the foreground are classified as the Ou Reang Ov Soil group.



**Fig. 2.** A schematic representation of the topographic relationships between Labansiek, Ou Reang Ov and Kompong Siem Soil groups



**Fig. 3.** View of the sloping land in the basaltic uplands of Ou Reang Ov district showing the Ou Reang Ov Soil group in the foreground.



**Fig. 4.** Typical profile for Ou Reang Ov Soil group in Ou Reang Ov district, Kampong Cham province. Note the abundance of ferruginous gravel from about 15 cm depth and below, and the basalt rock at 90 cm depth.

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