# Seasonal Waterfall over the Dolomitic Limestone Vein of the Pihimbi Ela at Sigiriya, Sri Lanka: A preliminary Study

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# Introduction

**Pihimbi Ela is a seasonal tributary (GPS Coordinates 7°59'13"N, 80°47'57"E) of the Kiri Oya Basin, which is connected to the Minneriya Tank and located on the Second Planated Surface in the Dry Zone.**

**The mean annual rainfall of the area varies between 1,250 and 1,500 mm and monthly rainfall 9seasonal) from October to December varies 300 - 600 mm and other months are evidently dry.**

**The average temperature from November to January varies from 25$^{o}$C – 27.5$^{o}$C and during other months are > 27.5$^{o}$C.**

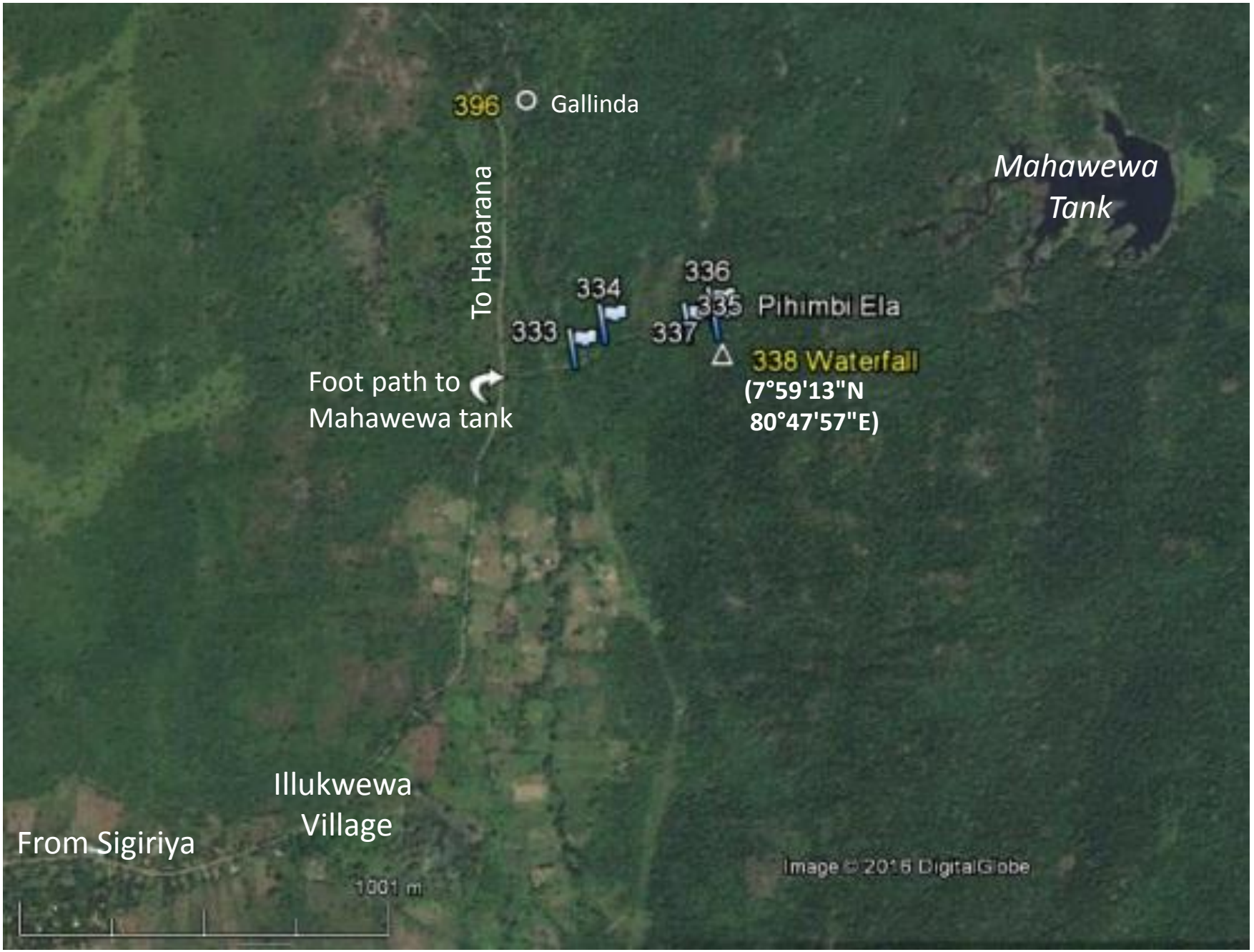
**Tropical Dry Mixed Evergreen forest is the foremost vegetation type, sustained by climate, topography as well as regional geology and soil of the area.**

# The Waterfall

During wet season the rain water forms a moderate to strong stream and drops over the precipice forming an impressive waterfall of nearly 4m or more in height.

**Seasonal Waterfall over the Dolomatic Limestone Vein of the Pihimbi Ela at Sigiriya, Sri Lanka (Photo taken on May 2014).**


**Location of Pihimbi Ela seasonal waterfall** ***(Source Polonnaruwa one inch sheet)***




**Location of Pihimbi Ela seasonal waterfall on Google Image**

# Approach:

**From Habarana Junction via Moragaswewa to waterfall about 9.2 km,**

**From Sigiriya UNESCO World Heritage site and Tourist Zone via Illukwewa village to waterfall about 7.2 km,**

**About 900 metres to the southeast from Gallinda,**

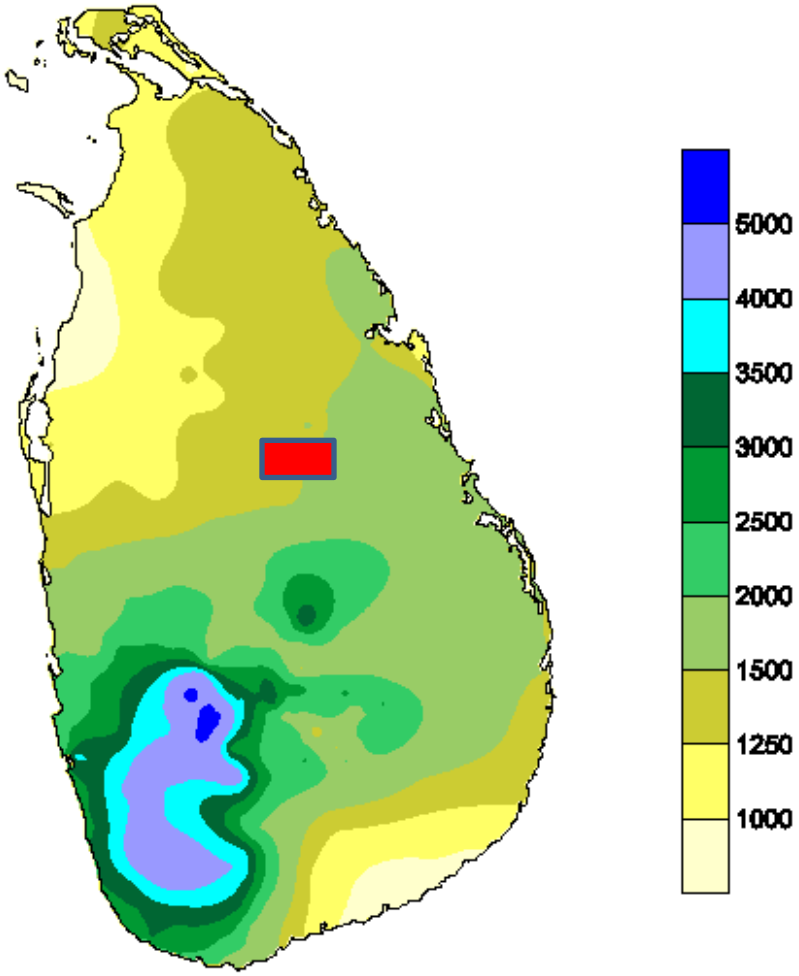
**The top of the waterfall is about 167m and lower part is 163m above from MSL.**

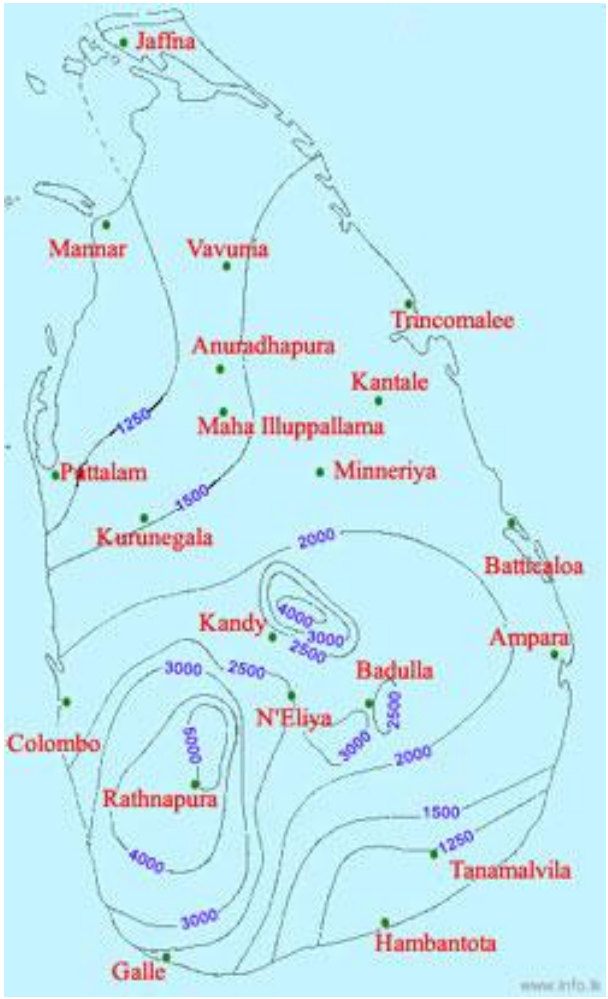
- **Pihimbi Ela seasonal waterfall is active only during the Monsoon season.**

- **A gravel path has been constructed to the Maha Wewa, and from this road a by path is to the base of the waterfall for visitors/tourists.**

- **The waterfall, the limestone rocks, the seasonal vegetation, are all are very attractive and aesthetically pleasing.**

- **There are narrow strips of land that allow elephants to move (elephant corridors) between habitat patches can be seen within the study area.**




**Annual Rainfall in Sri Lanka**

**North East Monsoon- November to February is the main rainy season of the study area**

# Collection of Information and Samples

- We have visited the study site on several occasions and the last visit was on November 26, 2014 to investigate the characteristics of the waterfall, rock and its surroundings as well as to collect samples.

- The location of the Pihimbi Ela waterfall on the dolomitic marble and calc-granulite is geologically significant.

- It also has geo-archaeological importance and geo-tourism potential as the area is placed in the vicinity of Ancient City of Sigiriya, Habarana Tourism Village and Minneriya Protected Wildlife Areas.

# ROCK TYPES OF THE AREA

**Cooray (1984) mentioned that metasediments and chanokitic gneisses are occur with close relationship with other rock types in the study area (Polonnaruwa Sheet).**

**The overall composition of the metasediments can be used to identify the original sedimentary rock, even where they have been subject to high-grade metamorphism and intense deformation.**

**The main rock types related to metasediment are:**

**(a) Garnet-sillimanite schists and gneisses**
**(b) Quartzites and quartz schists**
**(c) Quartz-feldsfar granulites and garnetiferous gneisses**
**(d) Mabels and calciphyres**
**(e) Graphitiferous schists**

A rock sample (Dolomitic Limestone) from Pihimbi Ela Waterfall area (collected in May 2014)

A weathered rock sample from surface of the Pihimbi Ela Waterfall area (collected in May 2014)

## LIMESTONE

- **The term limestone is applied in a variety broad sense to many forms of calcium carbonate, each with distinct physical properties and occurring in nature as a variety of rocks.**

- **Limestone vary greatly in both texture and composition.**

- **Some are hard, massive and break with a splintery or conchoidal fracture whereas others are crystalline rocks composed of crystals of calcite having granular texture and white colour.**

## MARBLES

**Marbles are limestones which have acquired a granular or crystalline texture and are composed of minute calcite interspersed with coloured veins of other minerals with flakes of talc and mica.**

**The term "marble" is also used, however, for various unaltered limestones which are capable of taking a high polish and of being used as decorative stones.**

## MARL

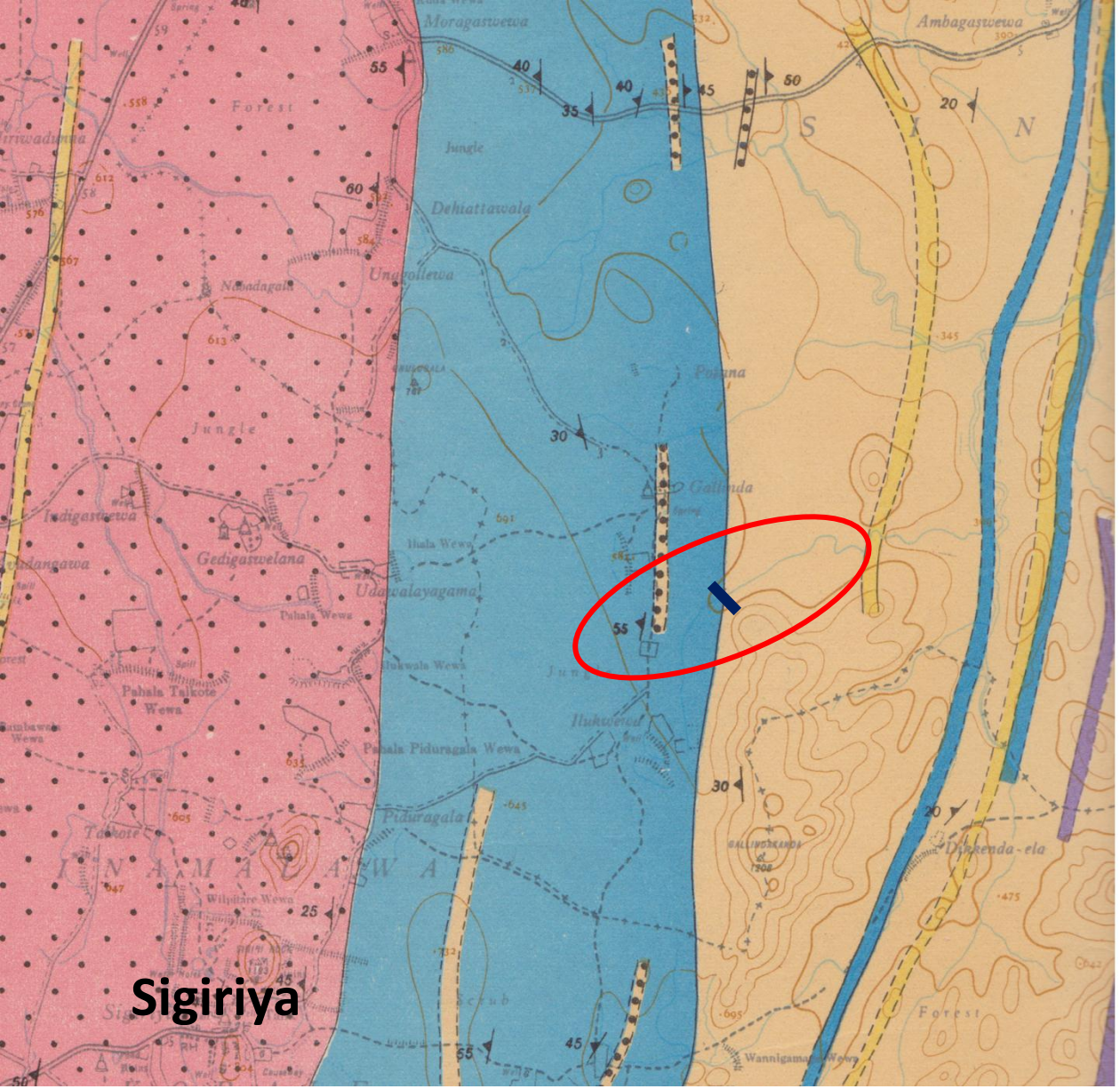
**Marl is the term applied for friable earthy materials having a natural mixture of calcium carbonate and clay.**

# DOLOMITE

**Dolomite consists of a double carbonate corresponding to $CaC0_3.MgC0_3$.**

**Pure dolomite contains 54.3 percent $CaC0_3$ and 45.7 percent $MgC0_3$.**

**However, in nature such ideal compositions are not generally available.**

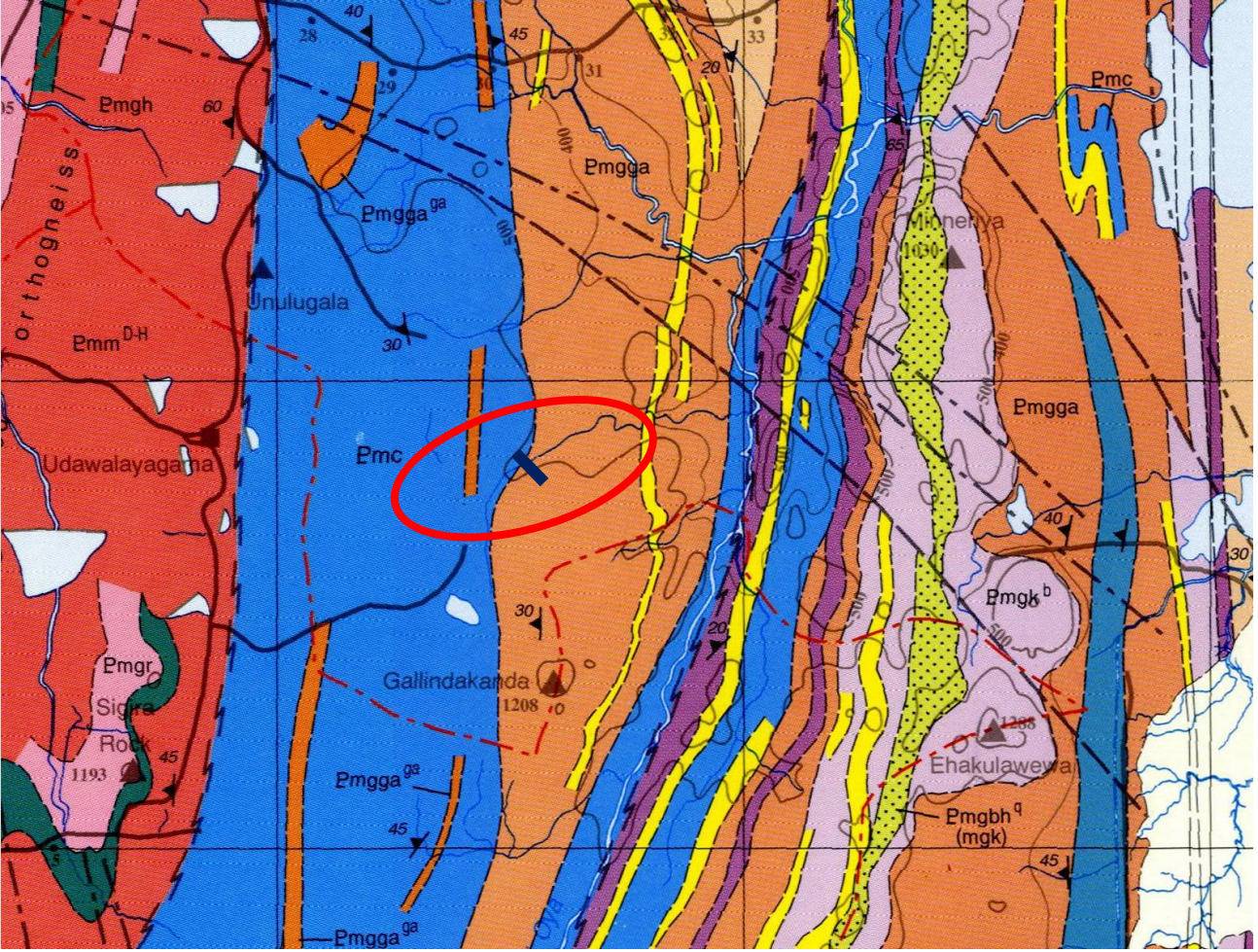



## GEOLOGY OF THE COUNTRY AROUND PIHIMBI ELA WATERFALL

- Quartzite
- Crystalline limestone
- Garnet-sillimanite-graphite Schists ( Type Khondalite )
- Migmatitic gneiss ( with garnet and sillimanite )
- Undifferentiated metasediments
- Charnockites
- Pihimbi Ela waterfall area

Source: P.W. Vitanage, 1995

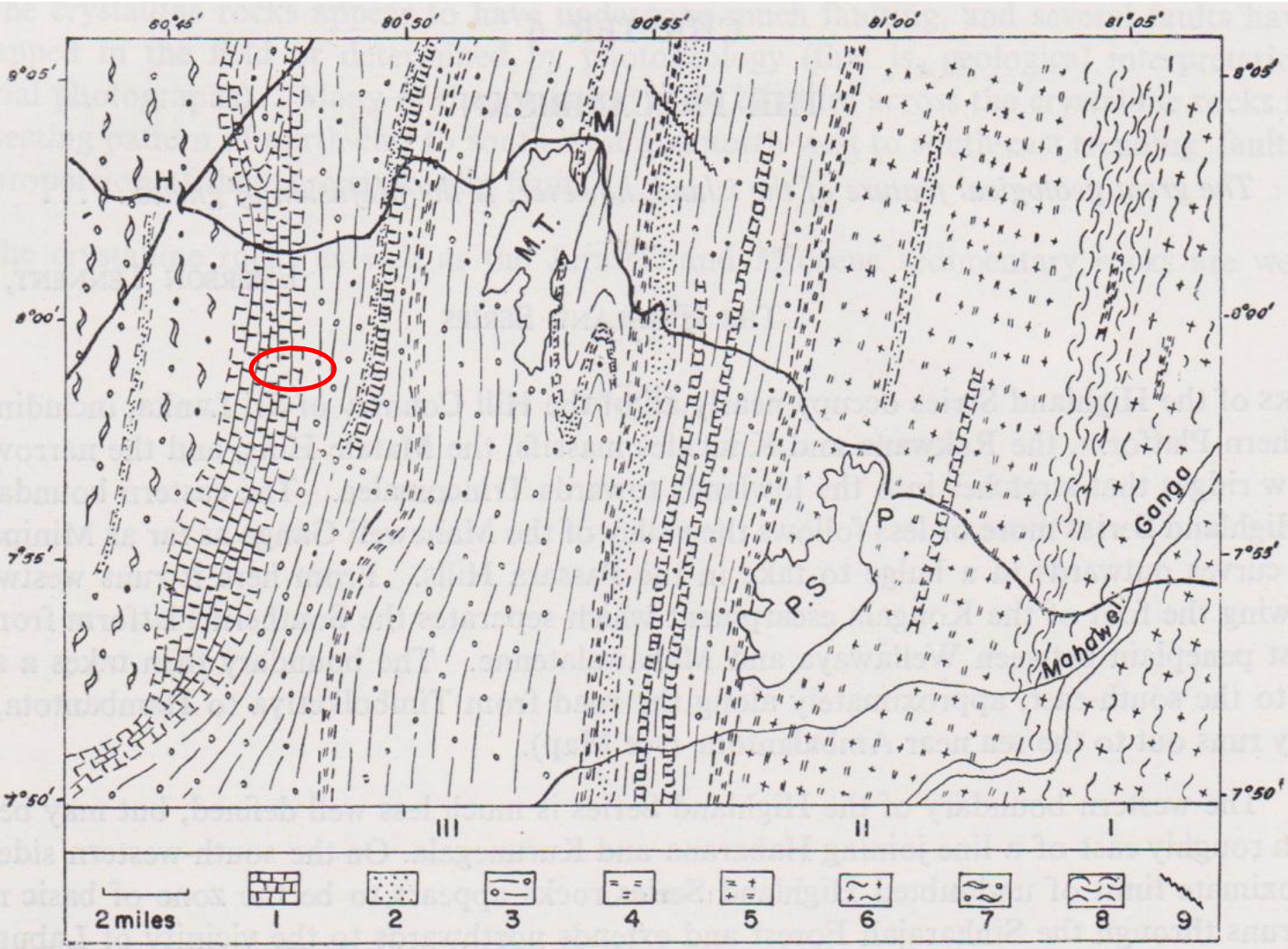
**Geology of the country around Pihimbi Ela waterfall area** ***(Source: Geology of the country around Polonnaruwa, Polonnaruwa one inch sheet, P. W. Vitanage, 1995).***




***Source: GSMB, Sri Lanka***

**Dolomitic Marble: Metamorphic rock composed mainly of dolomite crystals. The crystalline texture is the result of metamorphosis of limestone/dolostone by heat and pressure plus / minus the influence of aqueous solutions. Marbles are variable in grain size and colour (due to impurities), are often massive, but can also show banding and foliation.**

**Garnet-sillimanite-biotite gneiss ± graphite: pelitic schist or gneiss**




**Study Site**

**Source: P.G. Cooray, 1984**

Sketch map of the geology of the Polonnaruwa area. (*After P. W. Vitanage*, 1959)
I—Vijayan Complex, II—Transitional Zone, III—Highland Series.

1—marble, 2—quartzite, 3—garnet-sillimanite schist and gneiss, 4—charnockitic gneiss, 5—charnockitic biotite gneiss and schist, 6—granitic gneiss, 7—migmatitic gneiss, 8—crush zone, 9—fault.

H—Habarana, M—Minneriya, M.T.—Minneriya Tank, P—Polonnaruwa, P.S.—Parakrama Samudra.

# RESULTS

We observed that there are two main rock veins occur over the study area namely;

(a) Dolomitic marble and calc-granulite or gneiss in the Highland Complex, and

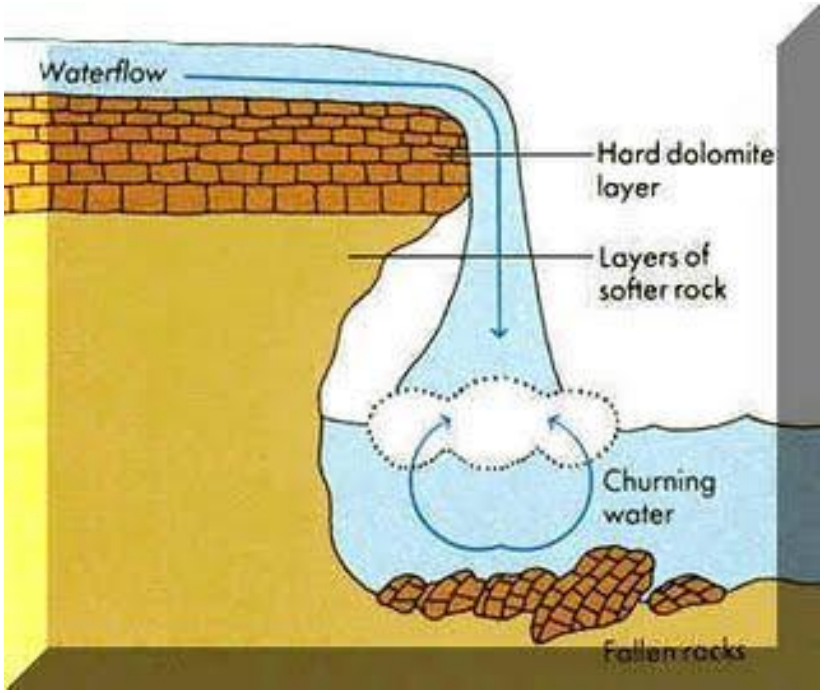
(b) Garnet sillimanite biotite gneiss ± graphite pelitic schist or gneiss.

**Morphologically, top of the waterfall is at 167m and lower part is 163m above from MSL, and is located over the dolomitic marble limestone formation, which is being eroded.**

**When a river crosses a band of hard rock differential erosion occurs. The hard rocks erode less than the softer rocks.**

**Due to this reason, the waterfall is formed at the site of a knickpoint. Water and its load gain velocity by falling at a waterfall thus increasing erosion at the bottom of the fall.**

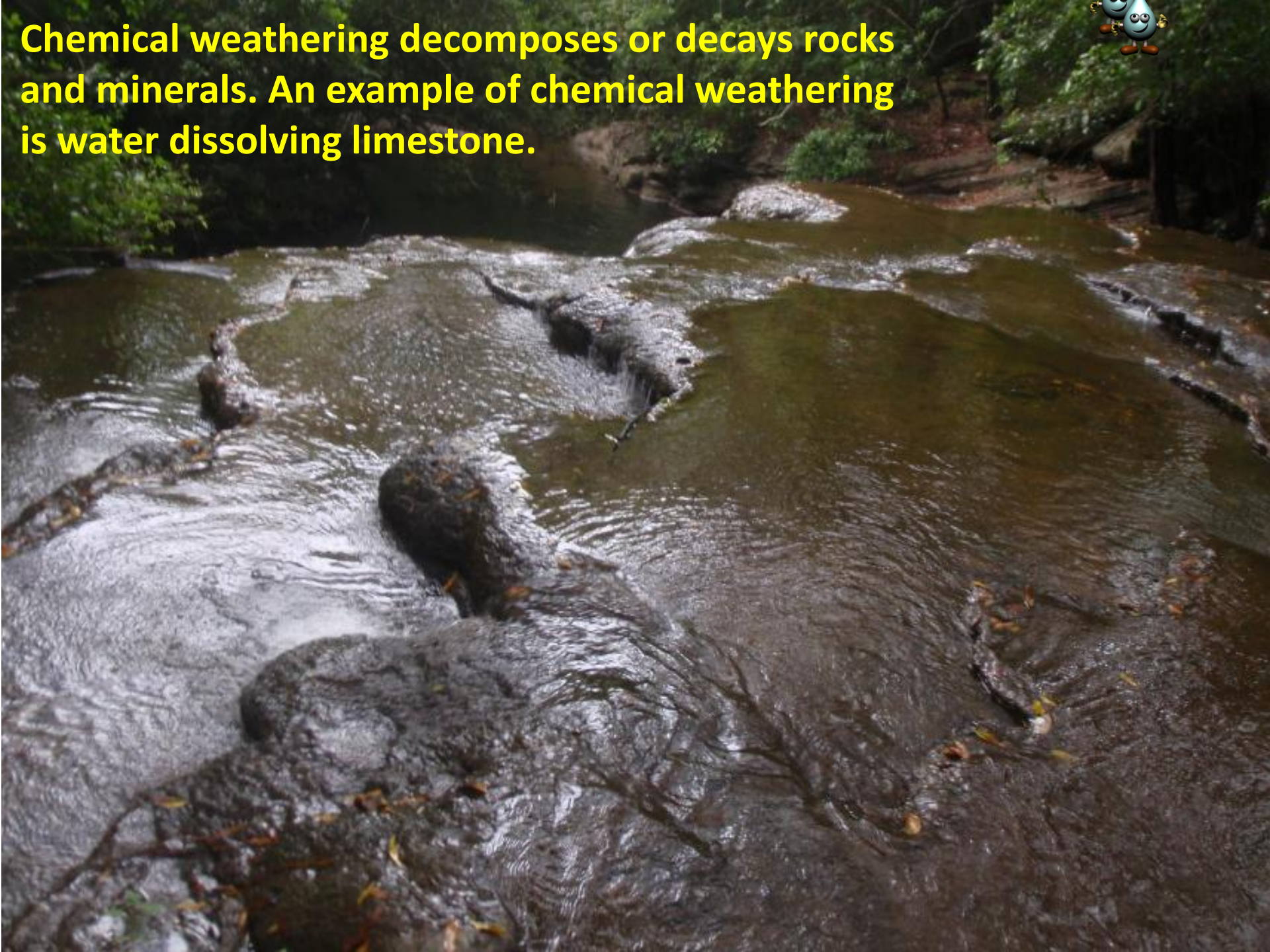
**Once a depression forms, currents cause pebbles to swirl around within it, increasing the erosion forming a plunge pool.**



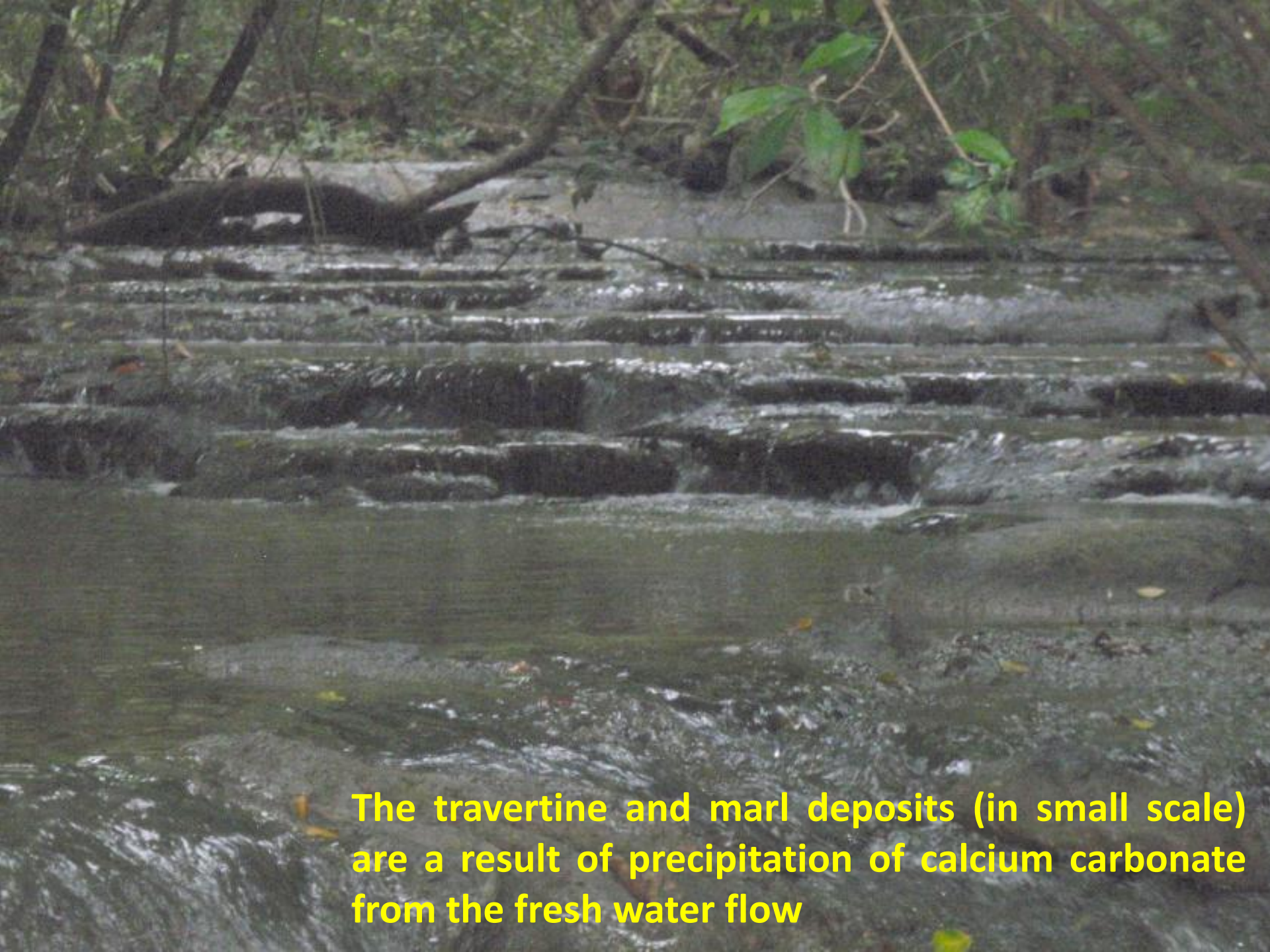

A water spring (Gallinda) is located close to the Pihimbi Ela Waterfall emerges through the dolomitic limesone vein of the Kiri Oya Basin


Pihimbi Ela seasonal waterfall
Photo taken on: May, 2014
Relatively deep pool (plunge pool) of water beneath a waterfall.


Pihimbi Ela seasonal waterfall
Photo  taken on: May, 2014



Chemical weathering decomposes or decays rocks and minerals. An example of chemical weathering is water dissolving limestone.


The travertine and marl deposits (in small scale) are a result of precipitation of calcium carbonate from the fresh water flow


Pihimbi Ela seasonal waterfall
Photo taken on: May, 2014


Pihimbi Ela seasonal waterfall
Photo taken on: May, 2014


Pihimbi Ela waterfall during
the rainy season
Photo taken on: 26.11.2014


Pihimbi Ela waterfall during the rainy season
Photo taken on: 26.11.2014


Pihimbi Ela waterfall
Photo taken on: 26.11.2014
plunge pool of
the waterfall


Pihimbi Ela waterfall
Photo taken on: 26.11.2014

**CONCLUSIONS**

**A number of large and small waterfalls are located in the Wet Zone of the Central Hill Country.**

**But, many of these waterfalls dry out and exist only as seasonal waterfalls.**

**In the study site, the dolomite is white, and the fascinating waterfall has following values and significance;**

- **Geologic and geomorphic values**
- **As a natural heritage**
- **Geo-archaeological**
- **Geo-tourism**
- **Wildlife sanctuary**
- **Location of elephant corridors**

# Acknowledgment

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# References

Abeysinghe, P.B. Limestone Resources in Sri Lanka. No 23. Natural Resources Energy & Science Authority, 47/5 Maitland Place, Colombo 7.

Cooray, P.G. 1984: The Geology of Sri Lanka (Ceylon). National Mepuseums of Sri Lanka Publication, Second (Revised) Edition, *pp. 81-88.*

Vitanage, P.W. 1995: Geology of the country around Polonnaruwa. *Memoir No. 1*. Geological Survey and Mines Bureau.

THANK YOU