CHAPTER 2 GENERAL DESCRIPTION OF STUDY AREA

2.1 GEOLOGY

2.1.1 TOPOGRAPHY AND GEOMORPHOLOGY

On the basis of the digital contour data of USGS, a topographic map of the study area was delineated as shown in *Figure 2.1*. The contour lines are at 20 m intervals.

The topography in general reflects the geological structure in Sri Lanka. The Highland Complex area is mountainous and Vijayan Complex area is a hilly or gentle slope area.

Most of the study area is a gentle slope area at an elevation of 200 m or less. The northern part of the study area is a little hilly at an elevation of 200 m or above and partially mountainous at the elevation of 400 m or above. The southern part slopes gently to the coastal area.

Geomorphologic characteristics in the southeastern part of Sri Lanka are shown in *Figure 2.2*. The area can be divided into 11 distinct regions by geomorphologic units. The mountainous area at the elevation of 600 m or above consists of 1) Upper Highland Planation Surface, 2) Middle Highland Planation Surface and 3) Transitional Slopes between theses planation surfaces. The eastern edge of the mountainous area overlaps generally with the western border of Monaragala district.

There are three planation surfaces in the area, namely 4) High Level Planation Surface, 5) Middle Level Planation Surface and 6) Low Level Planation Surface: 140, 300 and 600 m above mean sea level, respectively. Low Level Planation Surface is distributed from the coastal area to the inland area in the western Hambantota.

A hilly area where inselbergs are developed is distributed in the northern part of Monaragala. This hilly area, 7) Hills with Inselberg, are located from 140 to 600 m in elevation surrounding the mountainous area. 8) Transitional Slope is distributed in the western part of Hambantota in the elevation up to 140 m.

Most part of the study area is covered by 9) Micro Relief Planation Surface with an inclination of 0.4 degree or less up to the elevation of 140 m from the coastal area to the inland area.

10) Coastal Lowlands are distributed in the southern coastal area, and the eastern coastal area is classified as 11) Beach Ridges, Bars and Spits.

2.1.2 GEOLOGY

(1) General Geology of the Country

Precambrian high-grade metamorphic rocks underlie 90% of the Island of Sri Lanka. Previously, the Precambrian rocks were divided into major three groups: namely, Highland Group, Vijayan Group and South Western Group (Cooray, 1984). The latest geological maps published by Geological Survey and Mineral Bureau of Sri Lanka, 2001, also have divided the Precambrian basement into three lithotectonic units. These three units, however, are slightly different.

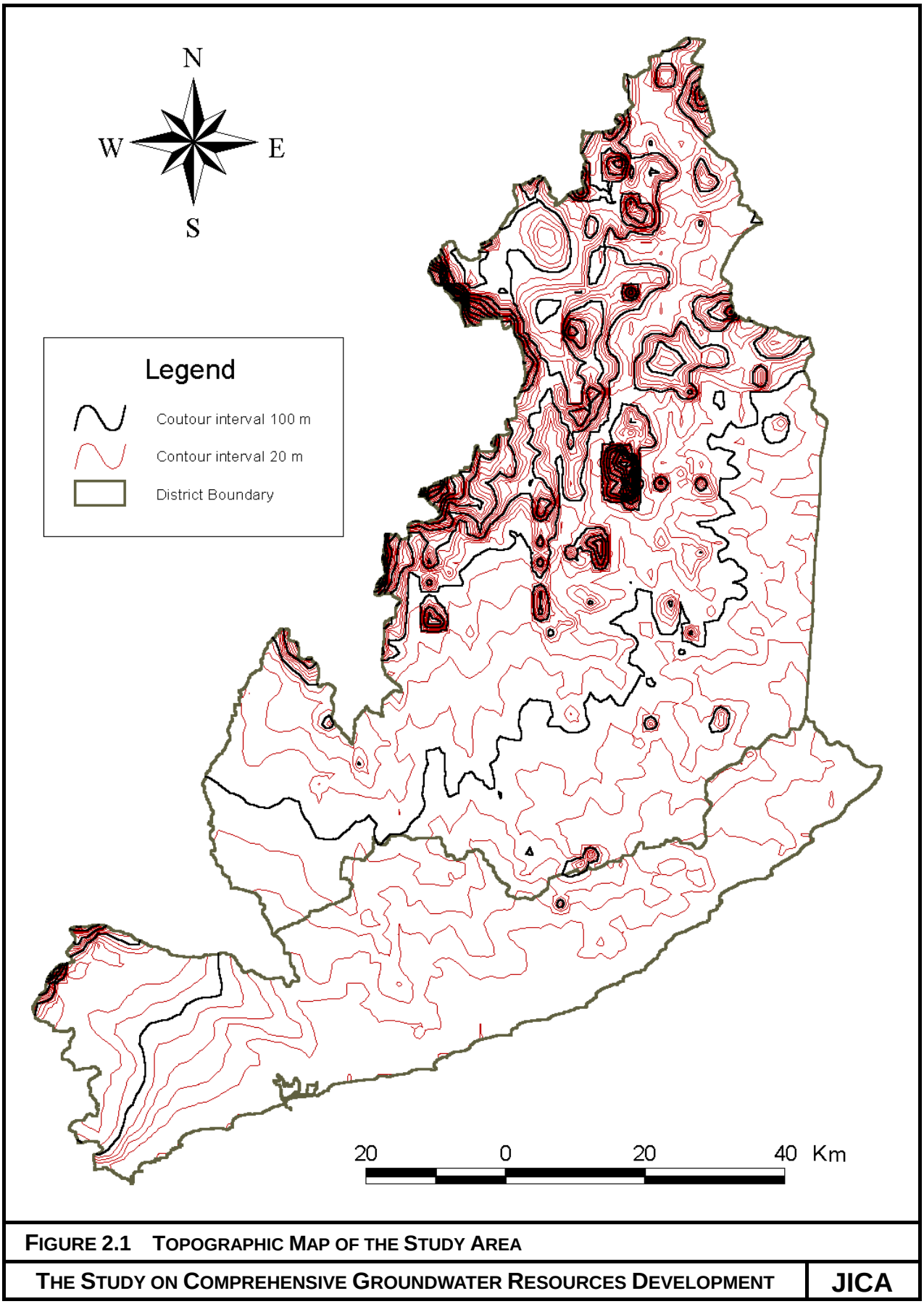

FIGURE 2.1 TOPOGRAPHIC MAP OF THE STUDY AREA

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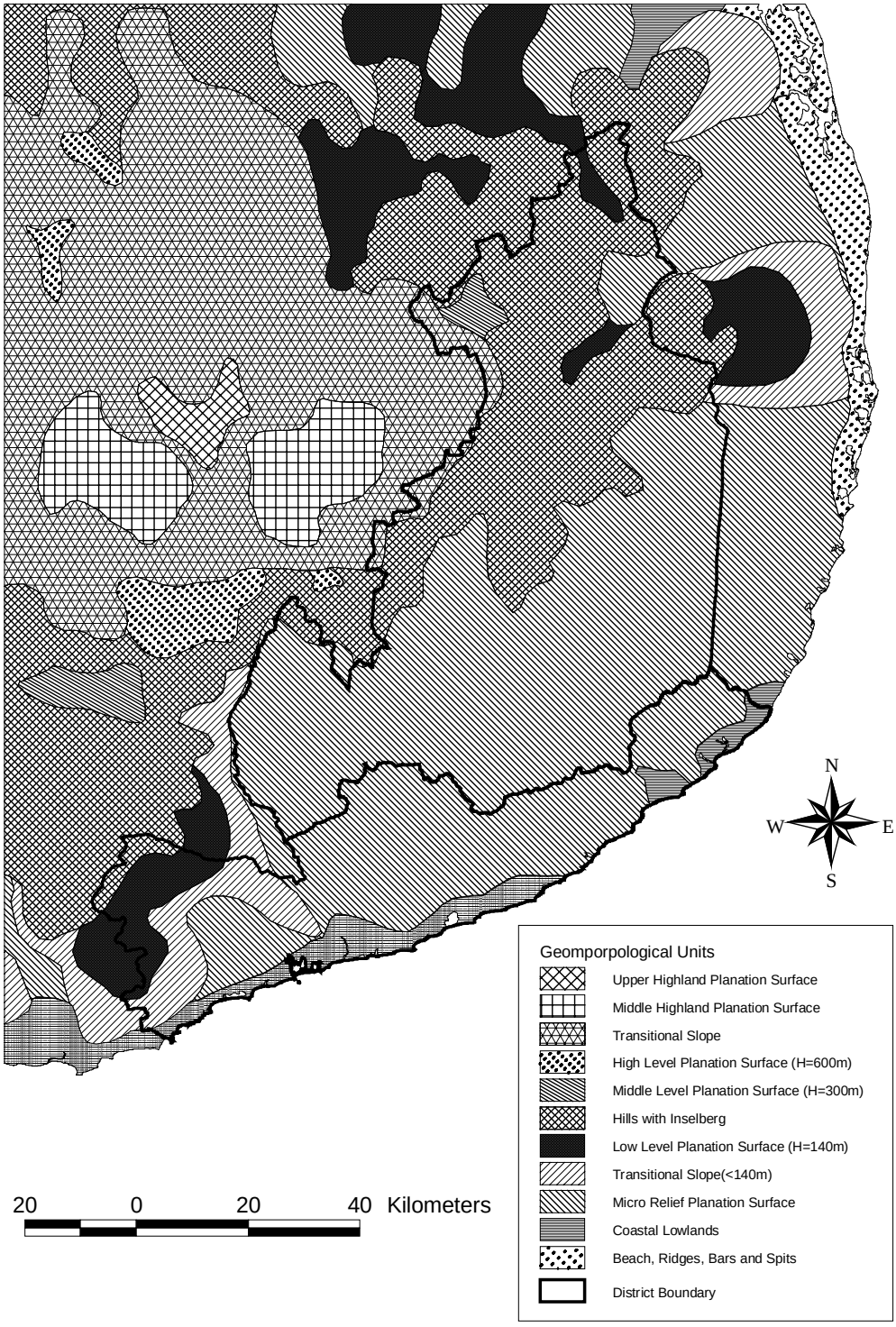

FIGURE 2.2 GEOMORPHOLOGIC CLASSIFICATION

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The three units are named Highland Complex that consists of the former South Western Group and the Highland Group (Voll, 1991), Vijayan Complex (formerly the Eastern Vijayan Group) and Wanni Complex (formerly the Western Vijayan Group). The distribution of these Complexes is shown in *Figure 2.3.*

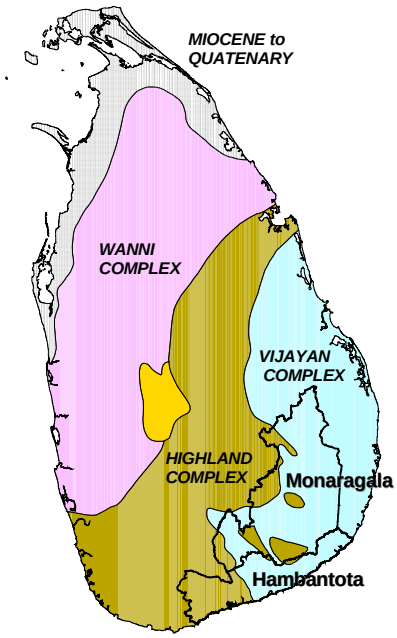

Figure 2.3 Distribution of Geological Complex

The Highland Complex is distinguished by a sequence of NW-SE to NE-SW trending metasediments and granulitic orthogneisses, which form the central belt including the rugged high ground occupying the central part of Sri Lanka. The metasediments are intimately tectonically interlayered with granitoid rocks and subordinate metabasic intrusive. These metasediments are Palaeoproterozoic to Archaean-age continental mass. Sedimentation was complete at 1980 Ma (mega-annum) which is the oldest age determination for rocks intrusive into the metasediments (Silva, 1981). The common occurrence of thick quartzites and carbonates (dolomitic marble and calcsilicate gneiss) suggests a general correlation with other Palaeo- to Mesoproterozoic shelf sequences.

The Vijayan Complex is distributed in the southeastern part of the Island of Sri Lanka. The most abundant rock type in the Vijayan Complex is a hornblende-biotite-bearing sequence of granodioritic to granitic orthogneiss (Liew et.al., 1991). Structures, metamorphic grade (Prame, 1991), shear-sense indicators (Hatherton, 1975) and gravity data (Schenk, 1991), are interpreted to mean that sub-horizontal thrusting is likely to have been responsible for the emplacement of the Highland Complex over the structurally lower Vijayan Complex. According to Vitanage (1985); however, the Kataragama outlier is interpreted as a rotated raft, but it may be a thrust klippe.

The distributed area of the Wanni Complex is the northwestern part of the Island. The Wanni Complex is characterized by thick sequences of orthogneisses comprising amphibolite-grade migmatitic, granitic and granodioritic gneisses, and, at lower structural levels, dioritic orthogneisses with minor gabbro. The relationship of the structurally highest metamorphic complex, the Wanni Complex (formerly the West Vijayan), to the Highland Complex, is equally

difficult to determine at the present time. The structurally lowest levels of the Wanni Complex are considerably more mafic and lithologically similar to gneisses described below the Kadugannawa Complex (Milisenda, 1991).

A geological map of the country is presented is *Figure 2.4.* The Study area is mainly underlain by the Highland Complex and the Vijayan Complex. Highland Complex mostly lies in western and northwestern hilly area and the Vijayan Complex exists in the eastern flat region. The major events in geological history are presented in *Table 2.1*.

(2) Geology of the Study Area

Geological map of the study area is shown in *Figure 2.5*. Rocks of the Vijayan Complex underlie widely in the area while the Highland Complex is restricted to the northwestern hilly part and the western part of the Study area. The Highland Complex rocks also occur in the form of outliers within the Vijayan Complex. Recent sediments occur in the southern and southeastern coastal belt.

1) Highland Complex

Rocks of the Highland Complex predominate in the western and northwestern part of the area and are characterized by interlayered metasedimentary rocks including garnet-biotite-sillimanite-graphite gneiss, crystalline limestone, calc-gneiss, quartzofeldspathic gneiss, garnet-biotite gneiss and garnet-bearing charnockitic gneiss. These metasedimentary rocks are also interlayered with more massive charnockites, probably of both sedimentary and igneous origin.

2) Highland Complex Outliers

The outliers which are named the Buttala Klippe, the Monaragala Range, the Kataragama Complex and others occur within the Vijayan Complex in the area. These outliers may be large remnants of the Highland Complex that escaped deformation and retrogression to form Vijayan Complex gneisses or thrust klippe.

3) Vijayan Complex

The Vijayan Complex contains variably migmatised, upper-amphibolite facies gneisses with a wide variation in the proportion of hornblende and biotite. The gneisses range in composition from gabbro-diorite to syenogranite, with the dominant rock types, hornblende-biotite gneiss and biotite-hornblende gneiss, being of tonalite to quartz-diorite composition. Isolated occurrences of pink feldspar granite, often controlled by numerous shear zones, typically form narrow elongated ridges a few metres to tens of kilometres long. Chemically, this Vijayan Complex rock suite defines a marked calc-alkaline trend that could probably be attributed to subduction-related magmatism at an active continental margin.

Major structural trends within the Vijayan Complex of the area are discontinuous and rather complexly oriented, forming several circular or dome-like structures (e.g., south of the Buttala Klippe). Numerous shear zones, mainly oriented NNW-SSE, dissect the area.

4) Ranna Rock Unit

A distinct amphibolite-grade outlier of Vijayan Complex is located within granulite grade Highland Complex rocks in the area around Ranna. This rock unit consists mainly of orthogneisses including partly migmatized hornblende-biotite and biotite-hornblende gneisses, amphibolite, granitic gneiss, charnockitic gneiss and minor paragneisses including garnet-bearing gneiss and calc-silicate rocks.

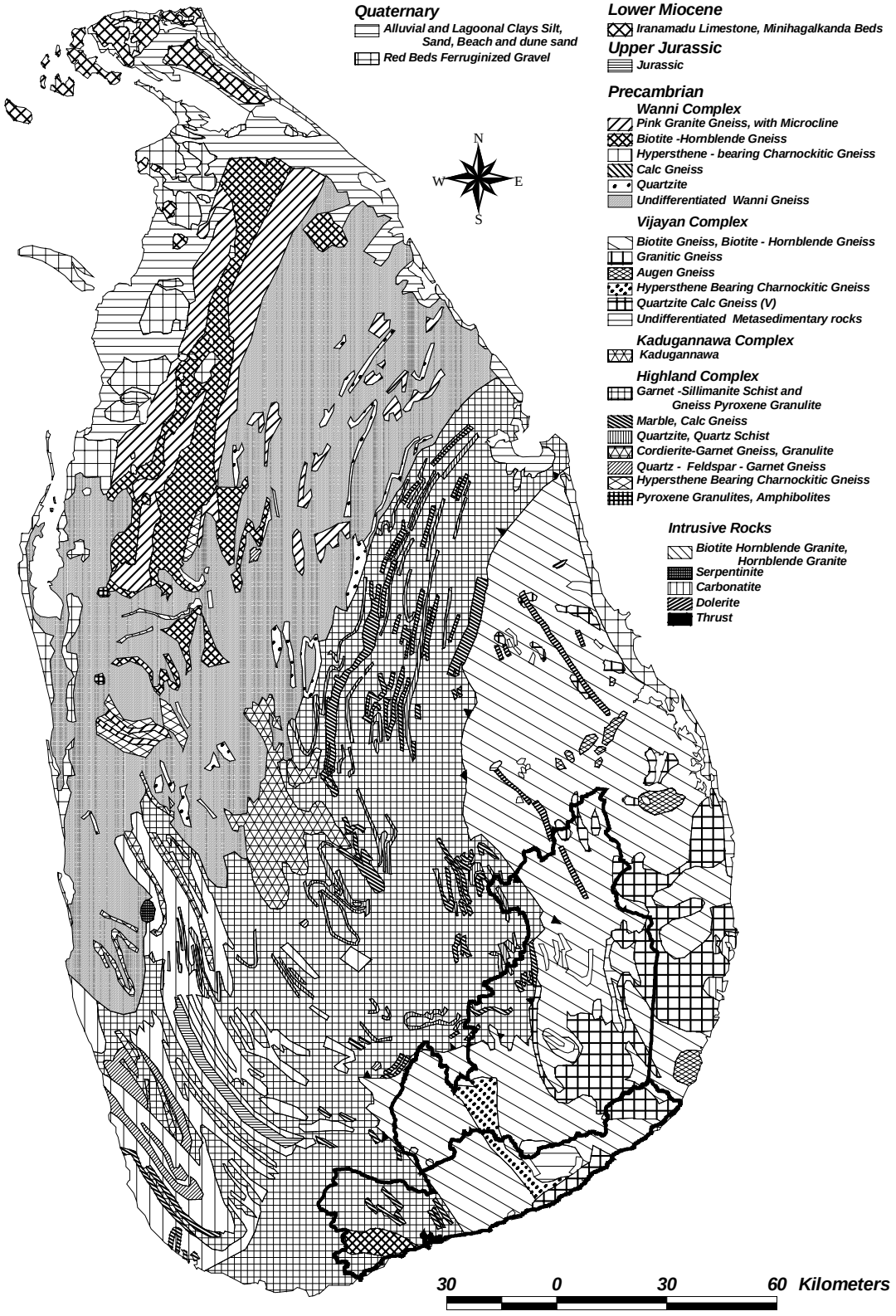

FIGURE 2.4 GEOLOGICAL MAP OF SRI LANKA

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Table 2.1 Major Events in Geological History of Sri Lanka. After Cooray, 1984.

ERA	SYSTEM/SERIES	AGE (m.y.)	SRI LANKA		Comparison with INDIA SHIELD
			GEOLOGICAL EVENT	FORMATION	
CENOZOIC	QUATERNARY	2	Sea level fluctuations, climatic and drainage changes Sedimentation on margins	Laterite, coral reefs YOUNGER GROUP - sands etc. OLDER GROUP - Red earth	Coastal deposits
	PLIOCENE	7	Uplift, erosion		
	TERTIARY MIOCENE	26	Submergence, sedimentation	JAFFNA LIMESTONE Minihagal kade Beds	
	TERTIARY OLIGOCENE	37			
	TERTIARY EOCENE	53		*Unconformity*	
	TERTIARY PALEOCENE	65			
MESOZOIC	CRETACEOUS	136	Uplift, penaplanation, down-faulting	?Dolerite dyke intrusion	Rajamahal lavas
	JURASSIC	190	Sub-mergence, sedimentation	TABBOWA, ANDIGAMA Beds	Upper Gondwana deposits of Madras Coast
	TRIASSIC	225			
PALEOZOIC	PERMIAN	280	?Uplift, erosion, peneplanation	*Unconformity*	
	CARBONIFEROUS	345			
	DEVONIAN	395			
	SILURIAN	430			
	ORDOVICLAN	500	Metamorphic "overprint"		
	CAMBRIAN	570			
PRECAMBRIAN	PROTEROZOIC	600			
		800	Metamorphic "overprint"	Pegmatites	Pegmatites, Chamundi Hill granite
		1000			
		1200	Granitic intrusion	TONIGALA GRANITE	Porphyry dykes, Sivamalai syenite
		1400	Granitisation, migma tisation, remobilisation	VIJAYAN COMPLEX charnockites in SW Group rocks	Biotite ages S. Maharashtra
		1600	Metamorphism, Deformation D3		
		1800		SOUTH WESTERN	
		2000	Metamorphism, granulite facies, deformation D2	GROUP HIGHLAND SERIES Kataragama, maligawila complexea	Gneisses of Kerala & Tamizhagam; ? Gneisses of Vizagapatam Closepet granite. Dharwar Super Group
		2200			
		2400			
	ARCHAEAN	2600	?Metamorphism Deformation D1	Relics in Highland series	Granulite Mobile Belt, Kerala charcockititc gneiss
		2800			
		3000			

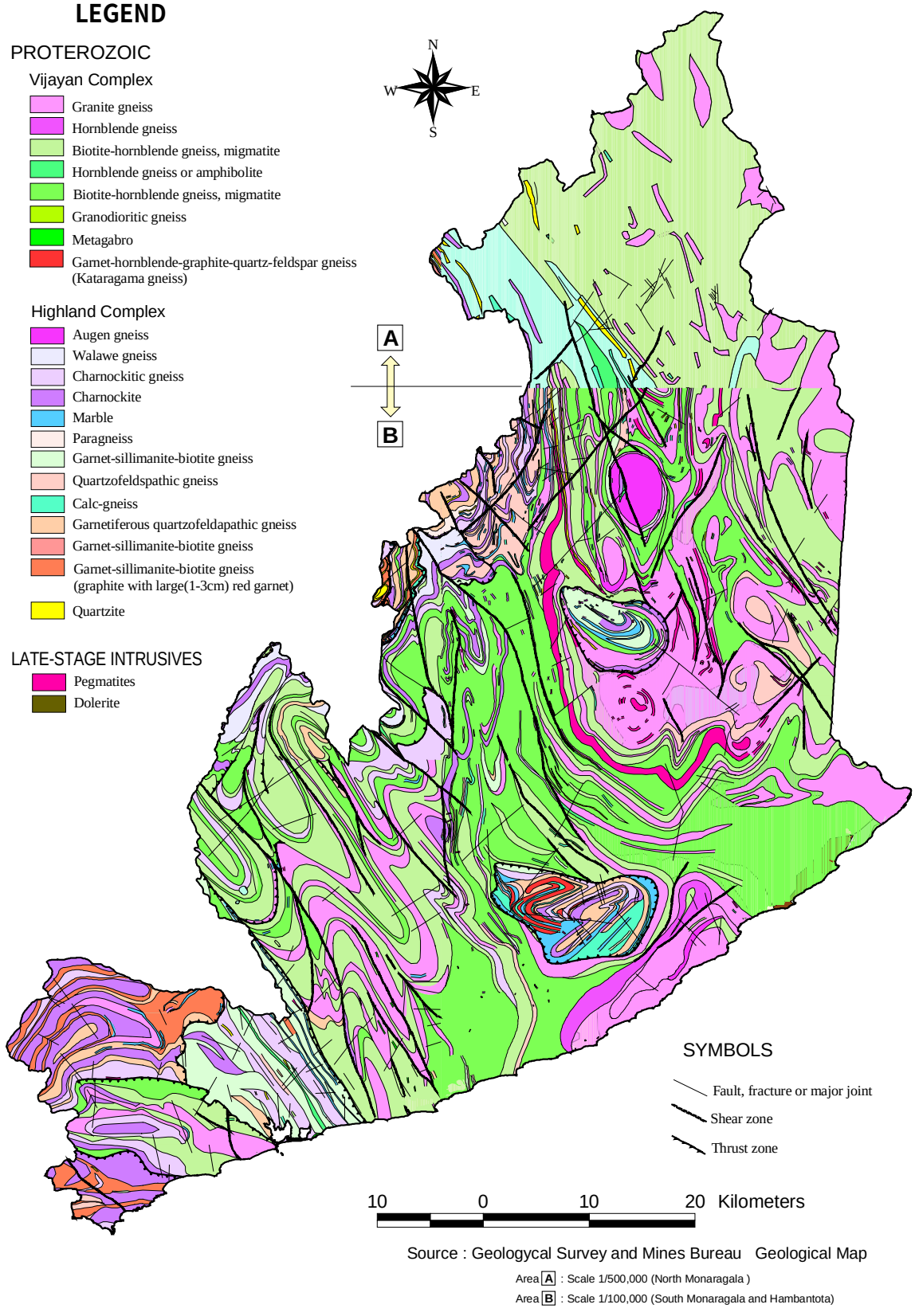

FIGURE 2.5 GEOLOGICAL MAP OF THE STUDY AREA

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