

Cross-border Collaboration on Geology and Mineral Resources of Cambodia-Lao PDR-Myanmar-Thailand-Vietnam (CLMTV)



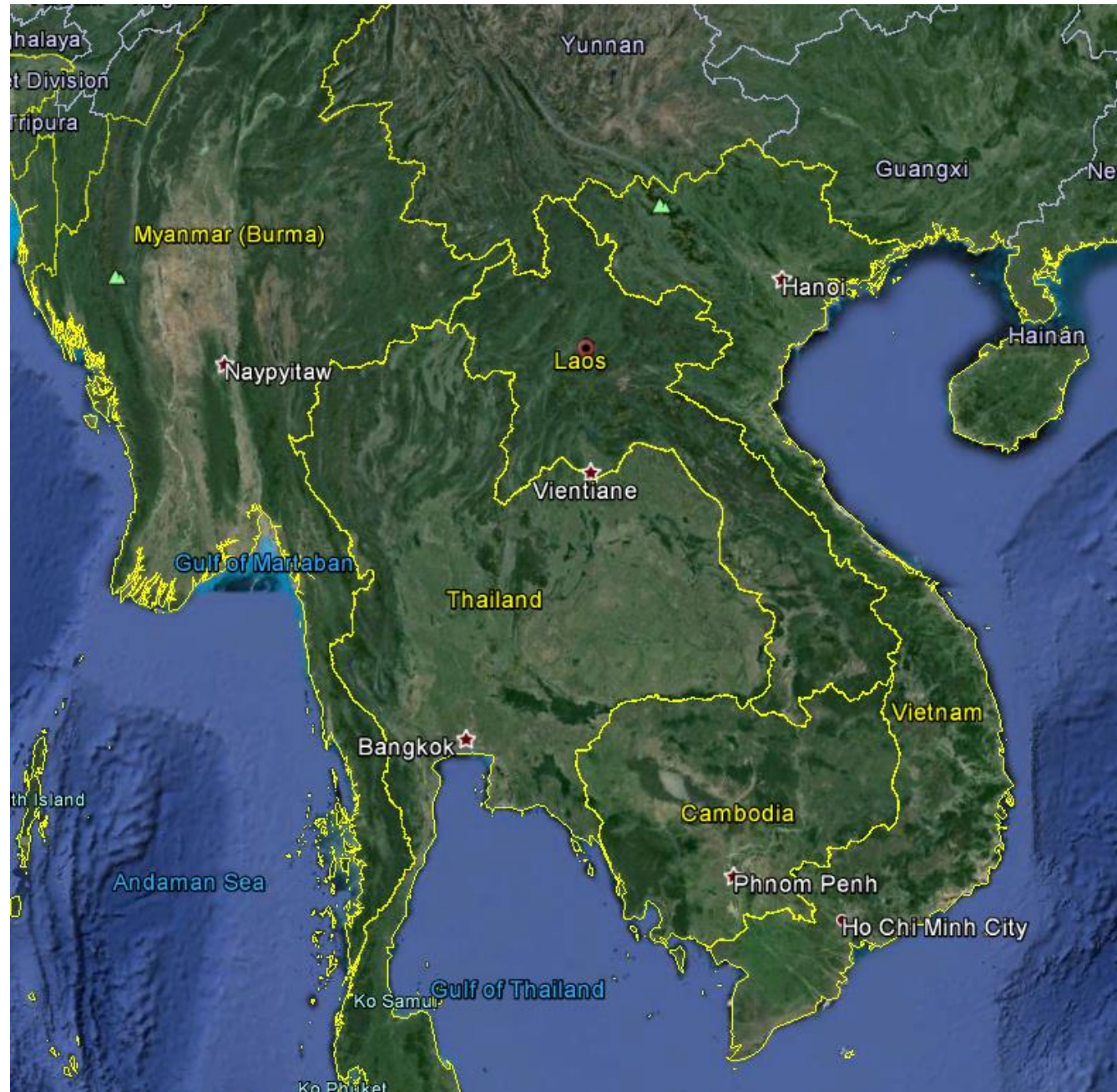
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Chiangrai, Thailand
Date 20 – 24 / 5 / 2016

Bordered:

5 Countries CLMTV

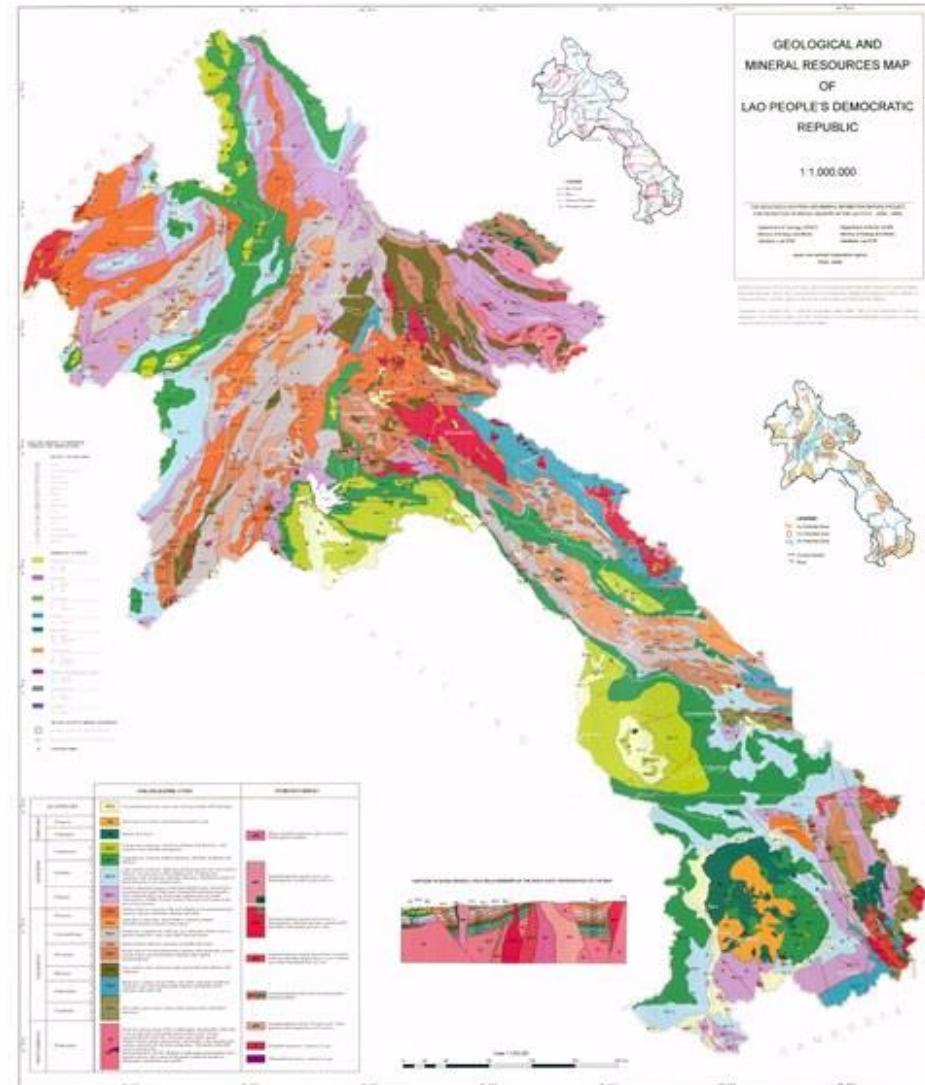
- Cambodia
- Lao PDR
- Myanmar
- Thailand
- VietNam



I. Geological and Mineral Resources Map of Lao PDR by JICA

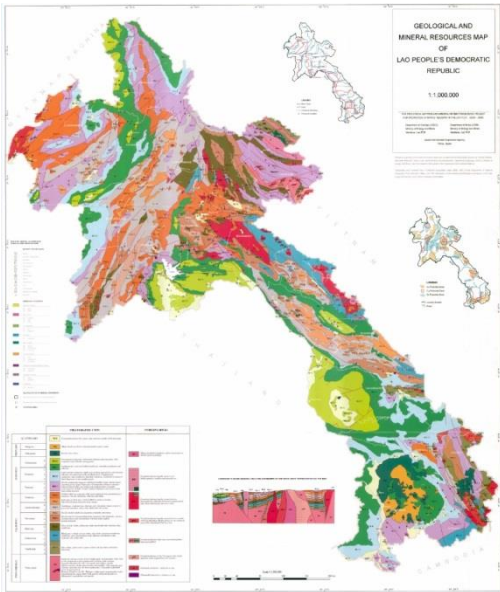
Scale: 1: 1000.000

- Geological and Mineral resources map scale 1: 1000 000 is recently recompiled with some modification new version by Japan International Cooperation Agency (JICA)
Second publication was in 2006 - 2008.



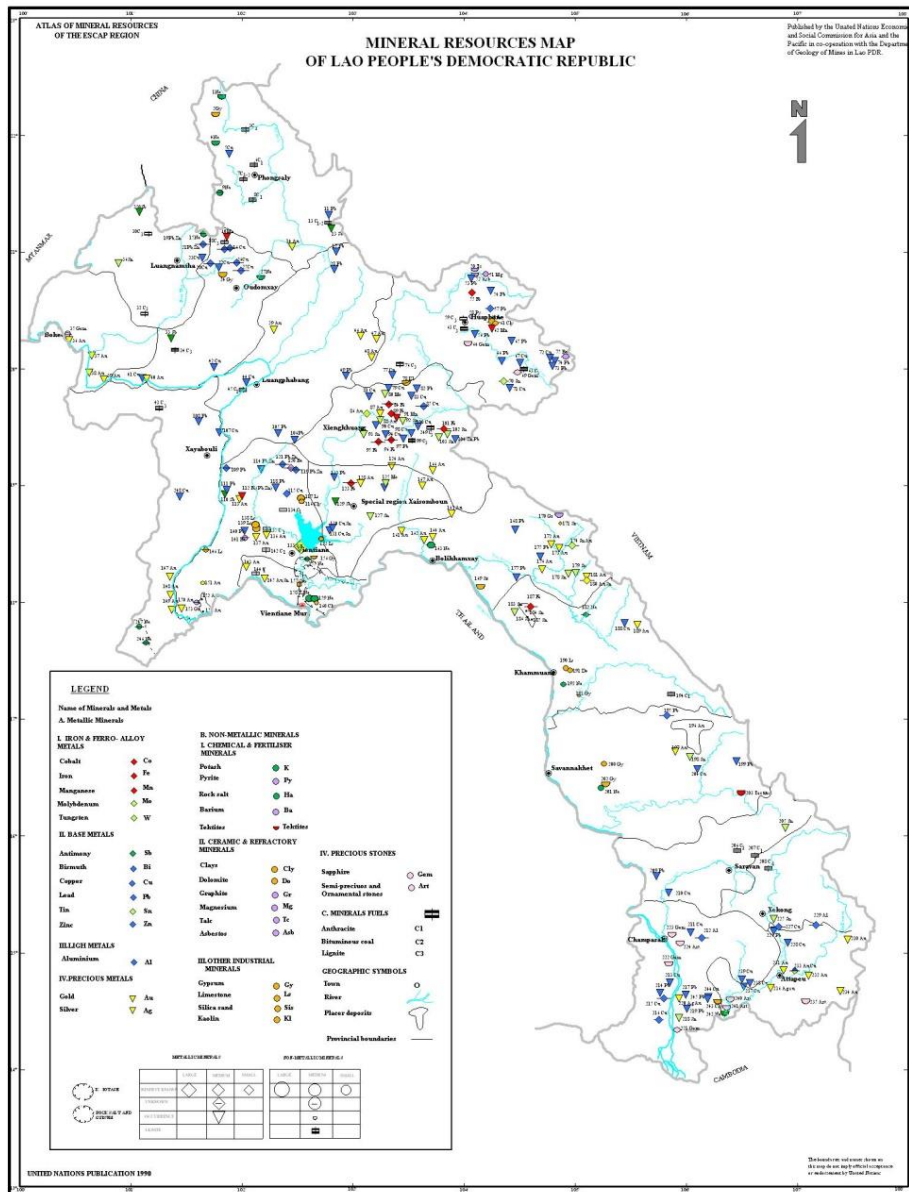
Regional Stratigraphy

Regional stratigraphy of Lao PDR was described as the following sequence from the Precambrian to Quaternary.



		STRATIGRAPHIC UNITS		INTRUSIVE ROCKS			
QUATERNARY		N2-Q	Unconsolidated gravels, sands, silts and clays mostly of fluvial origin				
	TERTIARY	Neogene	vNg	Alkali basalt lava flows with associated eruptive vents			
Paleogene		vPg	Basaltic lava flows.	gPd	Minor granitoid intrusions: gabbro-monzonite to dacitic quartz porphyry.		
MESOZOIC	Cretaceous	2	Mz2-2	Fine-grained sandstone, red-brown siltstone and claystone, with evaporite units of halite and gypsum.			
		1	Mz2-1	Conglomerate, medium-bedded sandstone, chocolate sandstone and siltstone			
	Jurassic	3					
		2	Mz1-2	Light-colored sandstone, light grey grading upward into red-violetish siltstone and claystone in the northern part. Conglomerate, sandstone, silty sandstone, chocolate claystone, interbeds or lenses of black limestone in the southern part.	gMz	Granitoid plutons: mostly megacrystic biotite-granite, tonalite and granodiorite.	
	Triassic	3					
		2	Mz1-1	Mostly continental sequence with local shallow-water marine facies persisting from Upper Palaeozoic. Continental red clayey arenites with occasional thin coal seams and conglomerates in parallel interrelations. Middle Triassic marine limestone units occur at the base of this interval.	mMz		
	PALEOZOIC	Permian	2	Pz3-3	Shallow shelf sea sequence with intercalation of volcanosedimentary sequence. Mostly sandstone, siltstone and shale.	mPz3	
			1	Pz3-2	Light grey to dark grey, thick-bedded to massive marine limestone, forming extensive karst tracts.	gPz3	Granitoid plutons: mostly granodiorite to monzogranite, with less abundant gabbro (mPz3) and silicic subvolcanic intrusive rocks.
		Carboniferous	2	Pz3-1	Sandstone, conglomerate, siltstone, grey claystone, lenses of grey to greenish limestone, marl, coaly shale and coal seams.		
			1				
Devonian		3	Pz2-2	Mostly shallow shelf sea sequences of muddy limestones.			
		2	Pz2-1	Mostly marine volcanosedimentary sequence with mudrocks, wackes, arenites, silicic and intermediate volcanic rocks, lightly metamorphosed.	gPz2	Granitoid plutons: mostly granodiorite to granite, with less abundant diorite phases in the southern part of the Sanakham-Pak Lay belt.	
Silurian		2					
		1	Pz1-3	Grey sericite schist, calcareous shale interbedded with siltstone, fine sandstone.			
Ordovician		3					
		2	Pz1-2	Black grey to black sericite schist, clay shale, quartzose sandstone, sandstone, grey thin-bedded sandy siltstone interbedded with andesitic and acidic tuff.	gPz1	Granitoid plutons with some associated gabbro intrusives (mPz1).	
Cambrian	1						
	2	Pz1-1	Mica schist, green schist, quartz schist and quartzite with black limestone				
PRECAMBRIAN	Proterozoic		PR	Scattered outcrop areas of low to high grade metamorphic rocks close to the northeastern and southeastern borders with Vietnam. Song Ma Massif in the NE: Low-grade mica schists, quartz chlorite-sericite schists and arenites, and marbles; this sequence may continue upwards into the lower palaeozoic. Ultramafic rocks (uPR) occur in narrow belts.	gPR	Granitoid plutons of the Truongson belt: alkali granites, some migmatites and tonalites.	
			uPR	Kontum Massif in the SE: Medium to high-grade metamorphic rocks: granitoid gneiss, mica schist (with garnet, cordierite kyanite or sillimanite), amphibolite and marble.	g	Granitoid intrusives: unknown in age	
					u	Ultramafic intrusives: unknown in age	

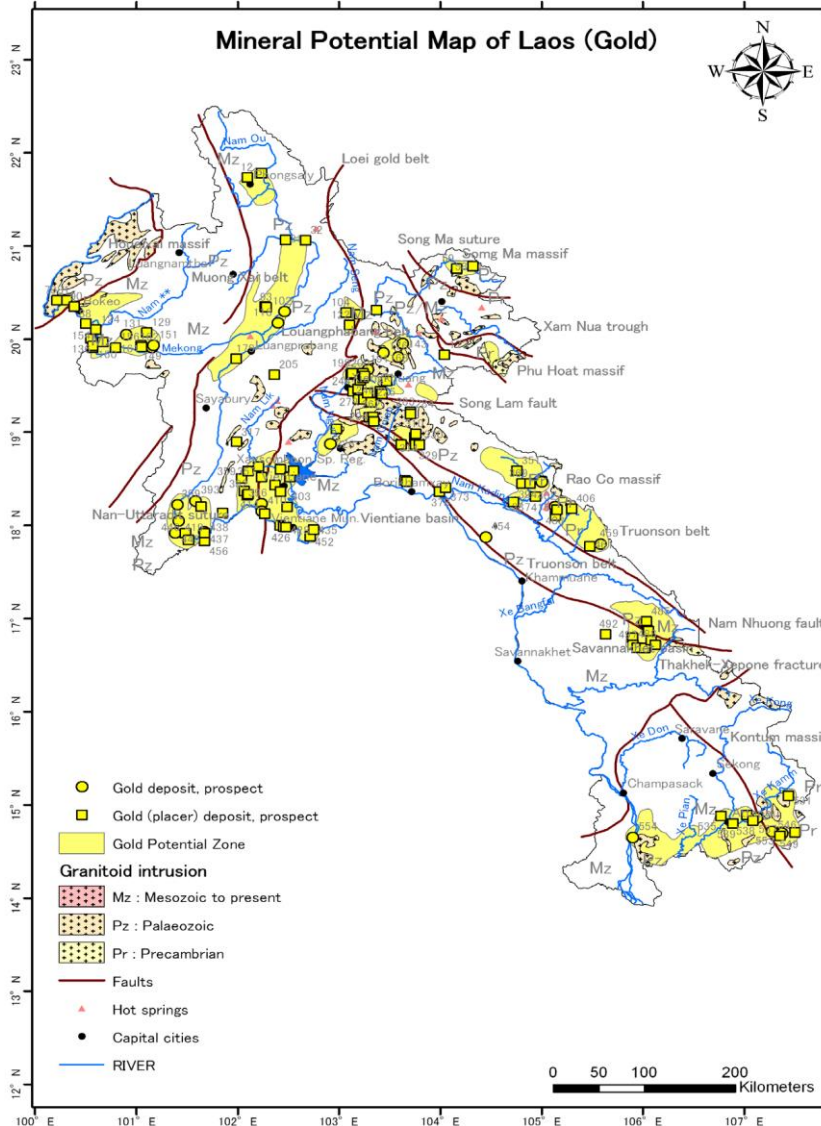
II. Mineral Resources.



Mineral resources map
1:1,500,000 publishing
by ESCAP 1990

- 250 minerals deposits and occurrences

1. Gold Potential

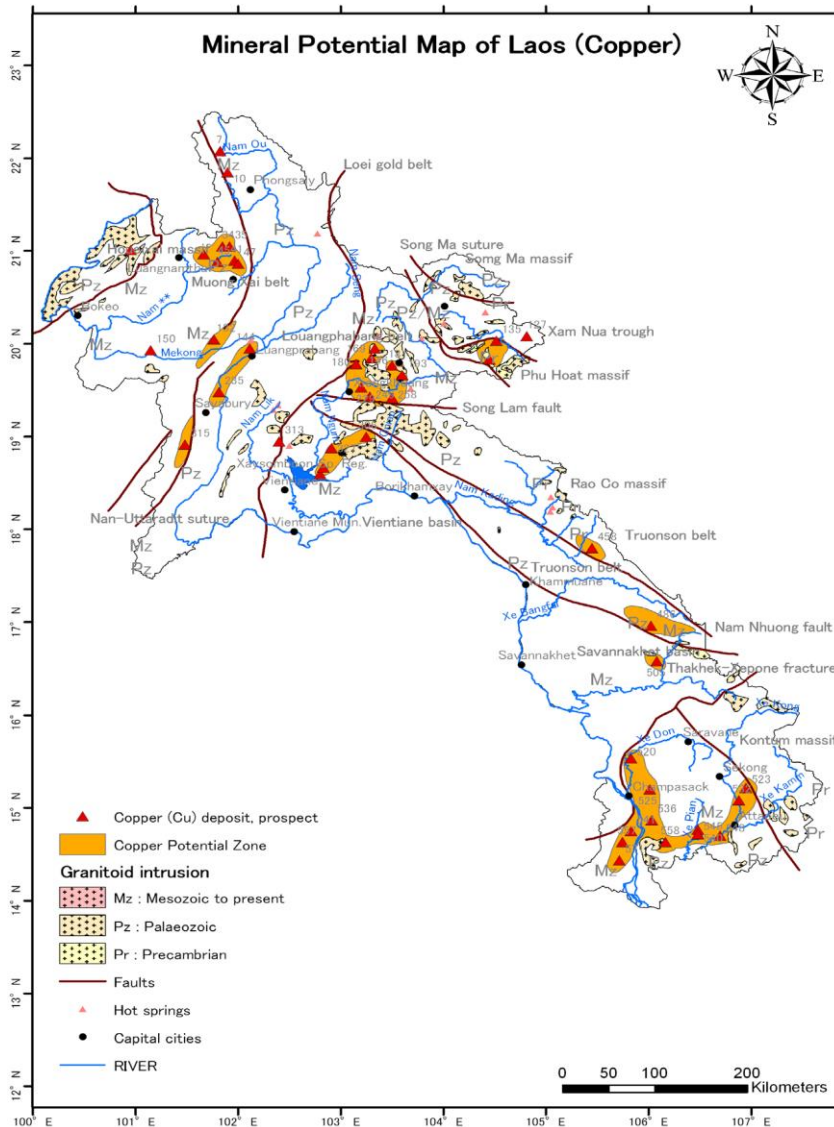


- Gold potential zones are mostly present around Late Paleozoic granite, near and along tectonic lines trending NE-SW and NW-SE. Numerous epithermal and placer gold deposits occur along rivers.
- **Sepon** gold deposit in Savannakhet province: Carline type, gold mineralization occurs as disseminations in Devonian to Carboniferous highly altered calcareous sedimentary rocks.
- **Phu Bia** gold/copper deposit in Vientiane province: primary porphyry deposit comprising sericite – altered feldspar intruded into calcareous sediments.
- And in around country.

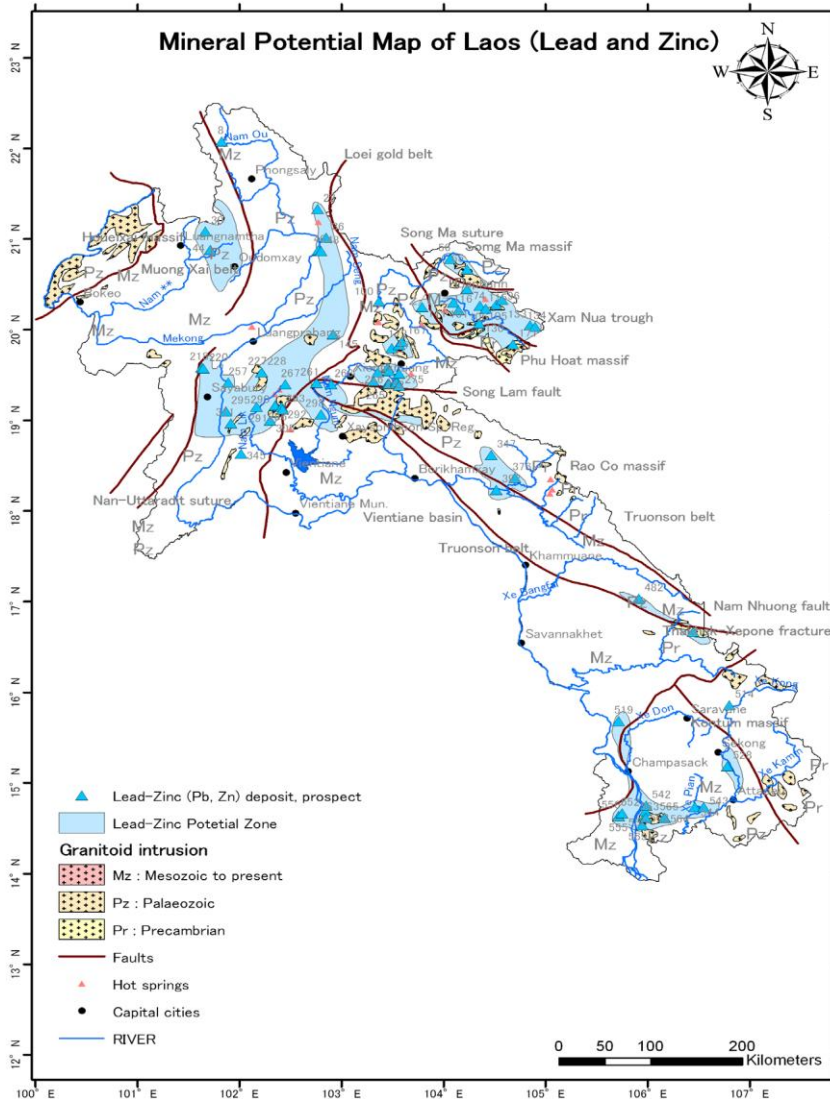


2. Copper Potential

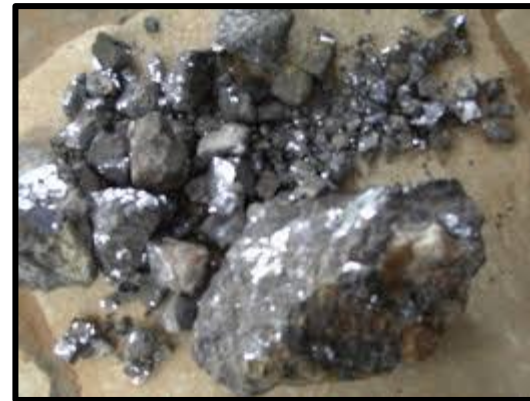
- Copper deposits and occurrences are mostly located in Phongsaly, Louang namtha, Oudomxay, Xiengkhouang and Savannakhet province.
- 2 types of copper mineralization: porphyry gold copper deposit forming quartz stockwork in granitic rocks and copper skarn deposit formed around country rocks.



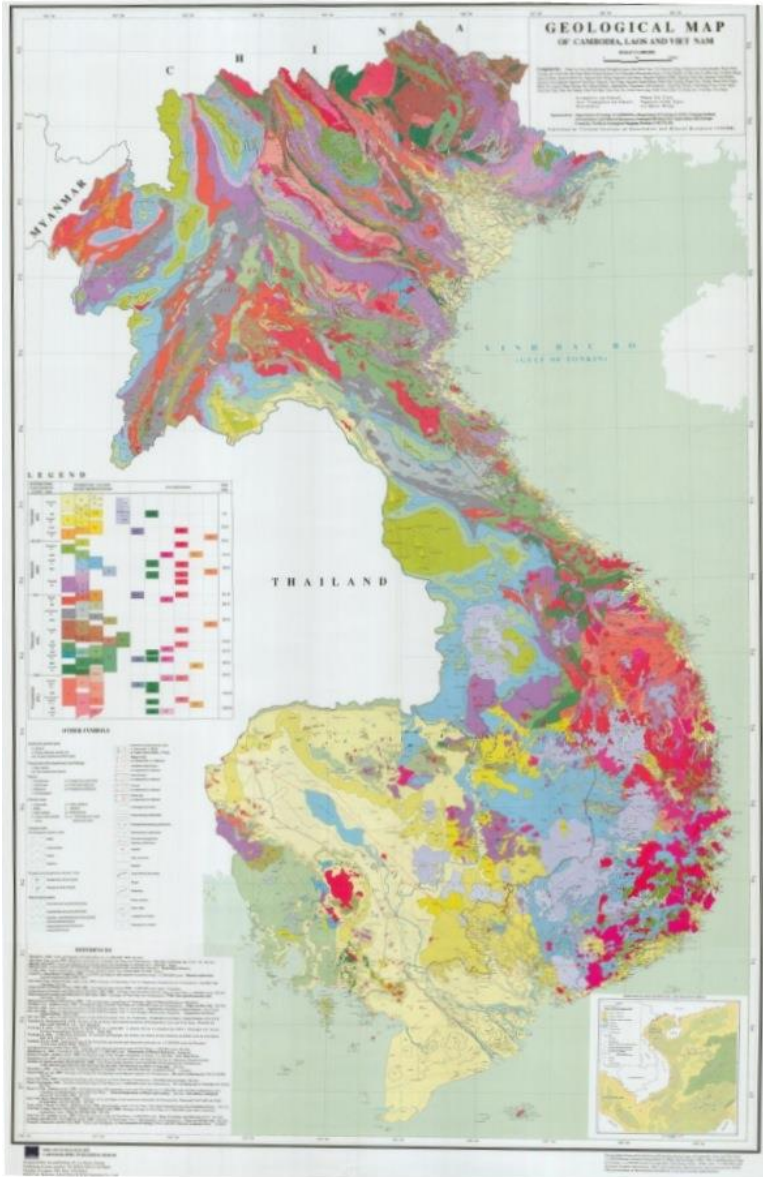
3. Lead and Zinc Potential



- Numerous lead/zinc deposits and occurrences are distributed in Loei fold belt (Vientiane & Louangprabang) and north of Indosinian fold belt (Xiengkhouang & Houaphan).
- They are divided into skarn type and Mississippi valley type.



Geological Map of Laos - Vietnam – Cambodia 1:1,500,000



- The geological map of the three countries is recently recompiled with some modification.
- The modified new version is published in October 2009 scale 1:1.500.000.

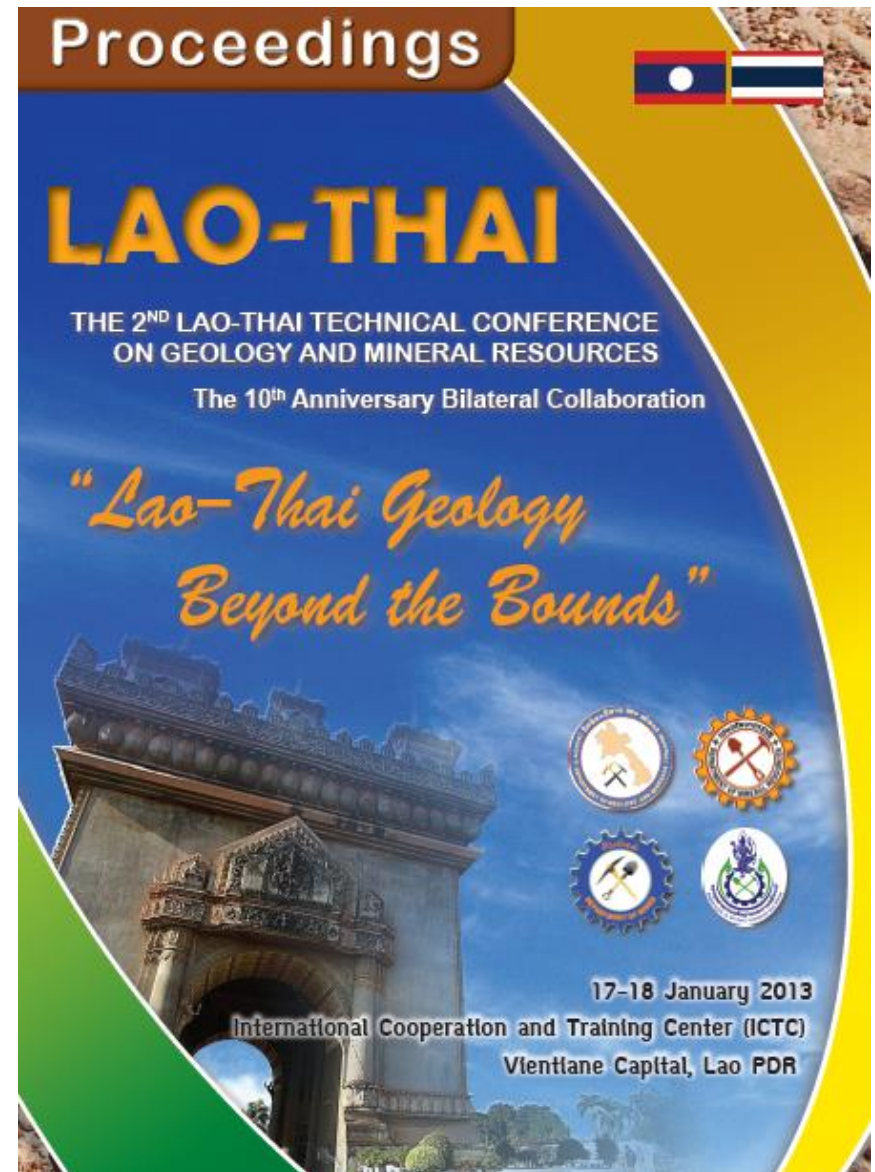
LAO PDR - THAILAND

Lao – Thai Project Geological Maps Scale: 1: 200,000

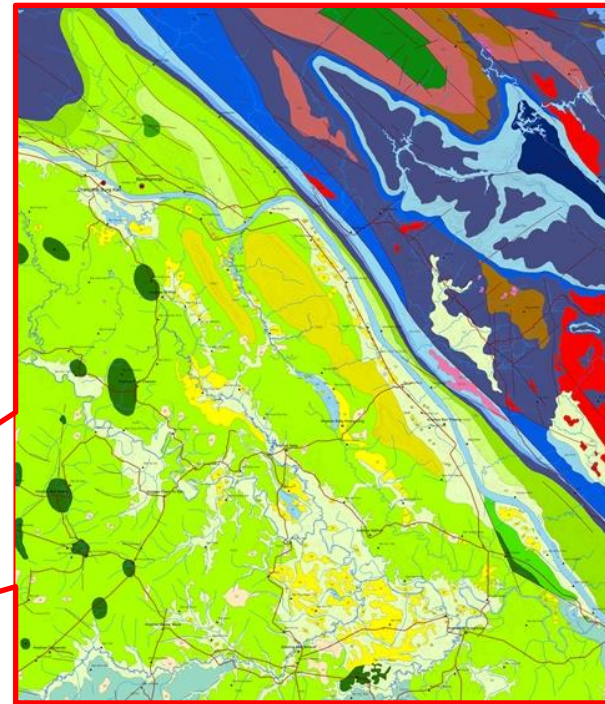
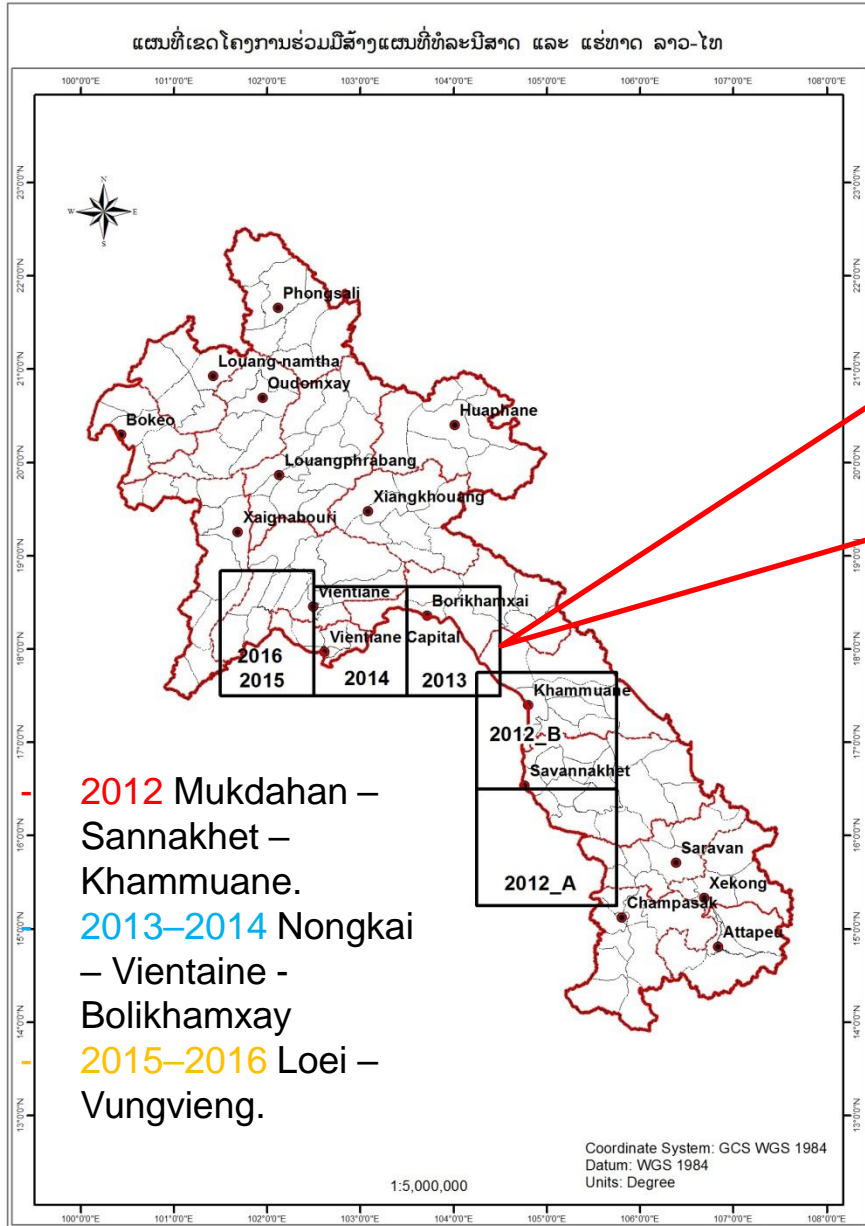
Lao-Thai technical conference on
geology and mineral resources
Lao-Thai cooperation project

Status of Seamless Geological
Mapping at Thai-Laos border Area

- Working under agreed MOU
- Team of Geologist from
both Laos and Thai



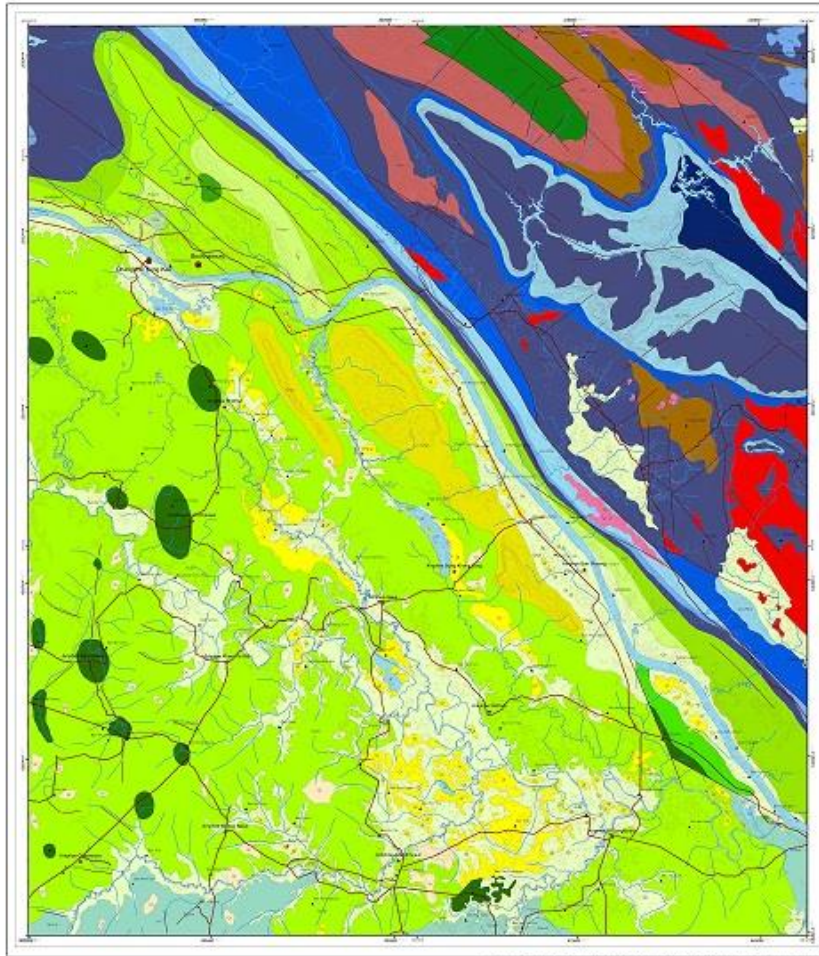
Lao – Thai Project Areas



AGE	CORRELATION UNITS EQUIVALENT			
	THAILAND		LAOS	
	Loei-Khorat Plateau	Vientiane Basin	Central Laos	
Holocene	Qa	Qa	apdQ	
Paleogene	Qt	Qv	aQII-III	
Neogene				
Cretaceous	Kptjw	Ksbjx	Knj	Nong Bua Fm
	Kptkl	Ksb2	Knj	Nam Noy Fm
	Kptw	Ksb1	JKnx	Nam Xot Fm
	Kms	Ktng	Jnp	Nam Phon Fm
	Kkk	Kbt	Jbl	Ban Lao Fm
Jurassic	Kpp	Kcp	Trk	Ling Khao Fm
	Ksk	Kba		
	Jpw	Jpp		
Triassic	Jpk	Jns		
	Trap	Trjpl		
Permian	Trgr	Triassic granite	T2sn1*	Say Phou Ngon subvolcanic intrusive complex
	Ptv	Pemo-Triassic Volcanic	P2-T1pt2	Phu Thoun Complex
Carboniferous	Pam	Namnanboran Fm	C-Pkm	Khammuane Fm
	Cws	Wang Saphung Fm	C1bl	Boulapha Fm
Devonian	Dpc	Pakchom Fm	C1tp	Na Pe Complex
	SDam	Namo Fm	D2-3pt	Pon Tui Fm
Ordo-Silur			D2-3tc	Tapachon Fm
			D1-2pk	Phon Keo Fm
			O3S1nh1	Nam Houay Fm

Lao – Thai Project Geological Maps Scale: 1: 200,000

THE THAI-LAO COOPERATION PROJECT FOR SUSTAINABLE DEVELOPMENT OF GEOLOGICAL RESOURCES 2013



The coordinates used between Thailand and Laos 2013-Phase 1 (Vientiane-Bolikhamsai Area)

Geological Unit	COORDINATE SYSTEMS	
	THAI (UTM)	LAOS (UTM)
Quaternary	488000 - 492000	488000 - 492000
Sedimentary	492000 - 496000	492000 - 496000
Metamorphic	496000 - 500000	496000 - 500000
Igneous	500000 - 504000	500000 - 504000
Other	504000 - 508000	504000 - 508000

แผนที่ธรณีวิทยา ไทย - ลาว 1:200,000
ລະຫວ່າງTLC -1 ພາກກາງ - ວຽງຈັນ - ບໍລິຄໍາຂັນ
GEOLOGICAL MAP OF THAI - LAO 1:200,000
SHEET TL C-1
NONG KHAI - VIENTIANE - BOLIKHAMKAI AREA

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GEOLOGIC UNITS EXPLANATION

SEDIMENTARY AND METAMORPHIC ROCKS

- Quaternary deposits (Yellow)
- Sedimentary rocks (Green, Blue, Red, Brown)
- Metamorphic rocks (Purple, Grey)

IGNEOUS ROCKS

- Granite (Pink)
- Diorite (Light Blue)
- Basalt (Dark Blue)
- Andesite (Light Green)
- Other igneous rocks (Dark Green, Orange)



III. Cross-border

Cross-border Collaboration on Geology and Mineral Resources

CLMTV

CAMBODIA

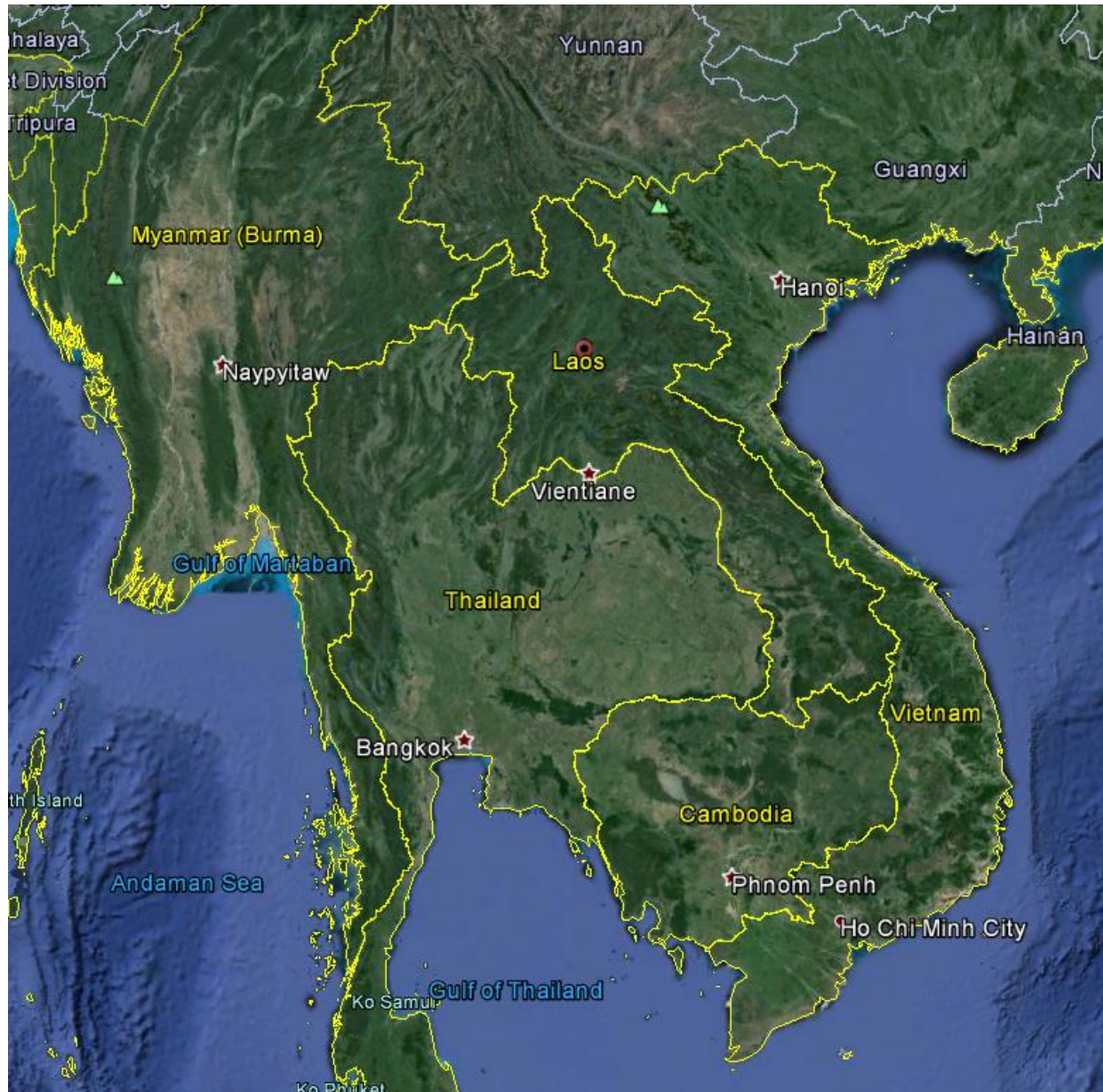
LAO PDR

MYANMAR

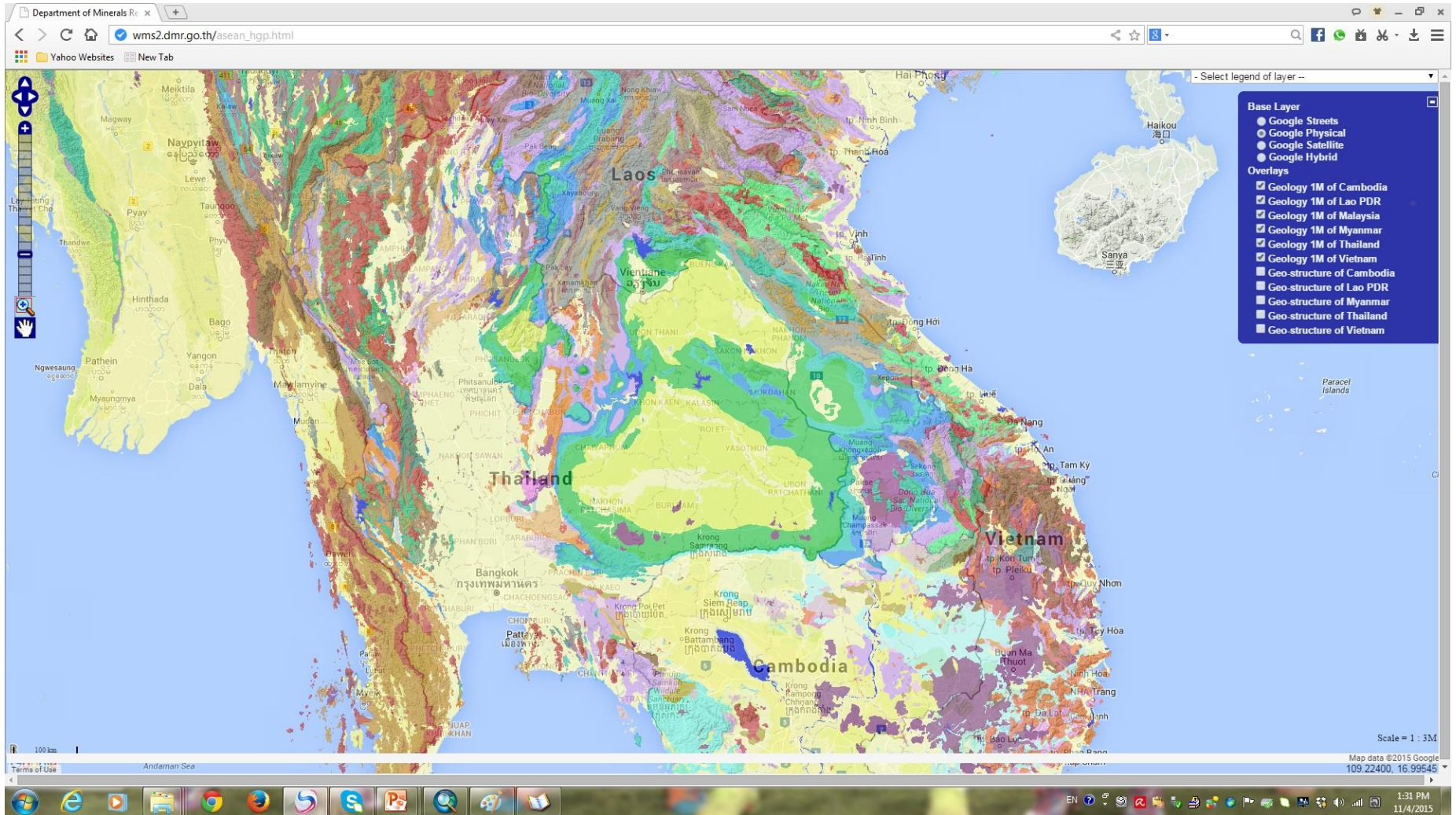
THAILAND

VIETNAM

CAMBODIA – LAO PDR - MYANMAR – THAILAND - VIETNAM

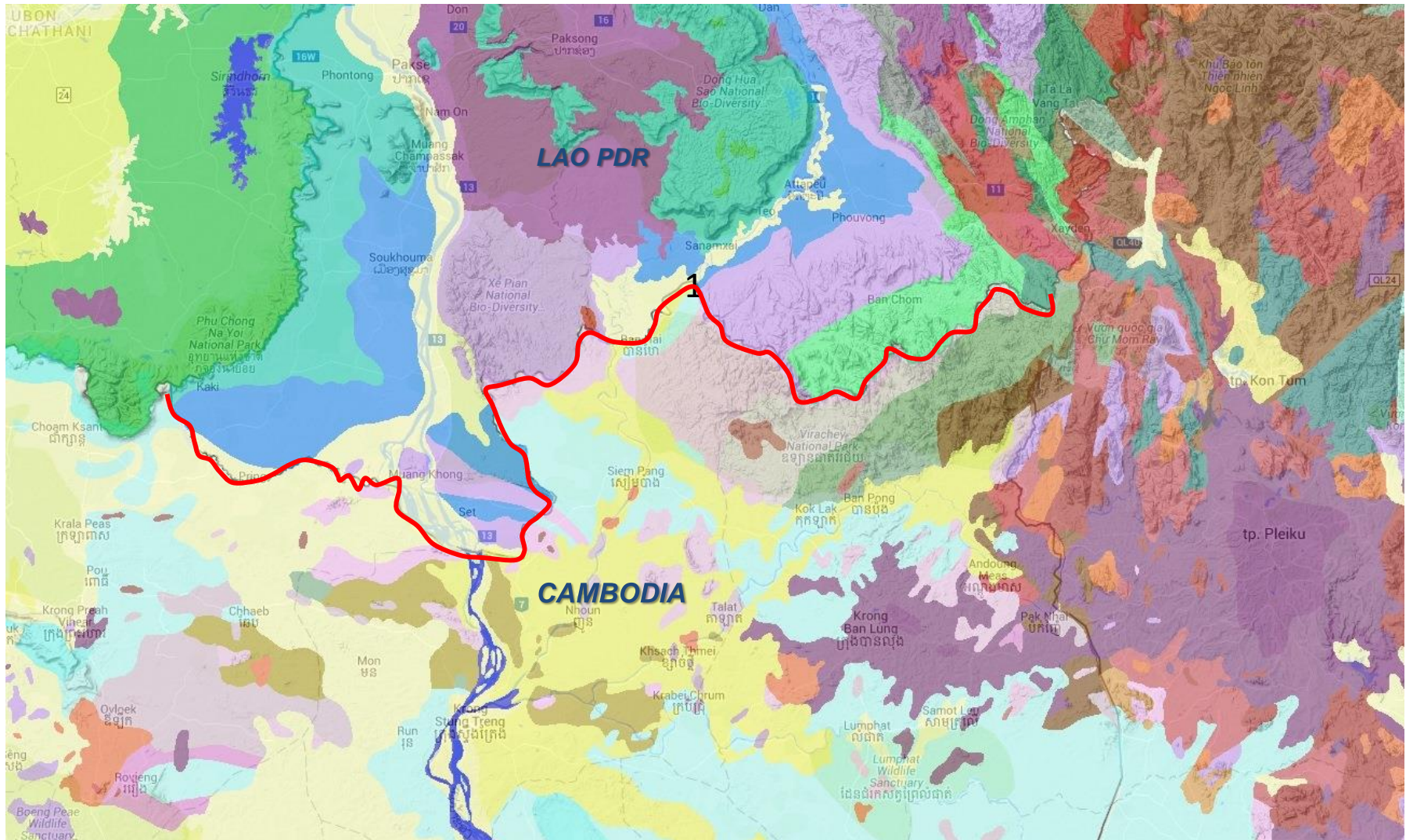


Geological of Asean by CCOP

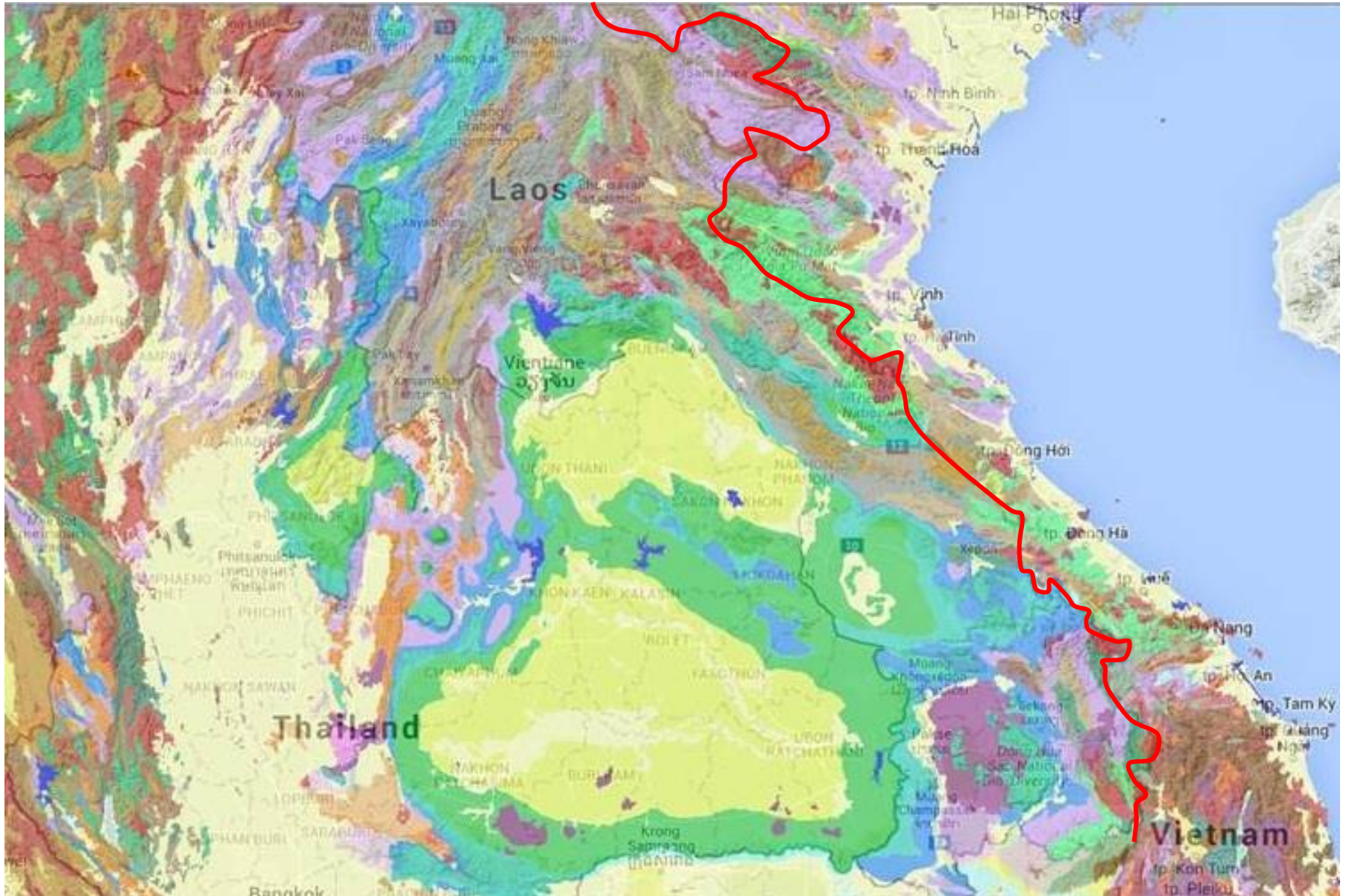


Cross-border

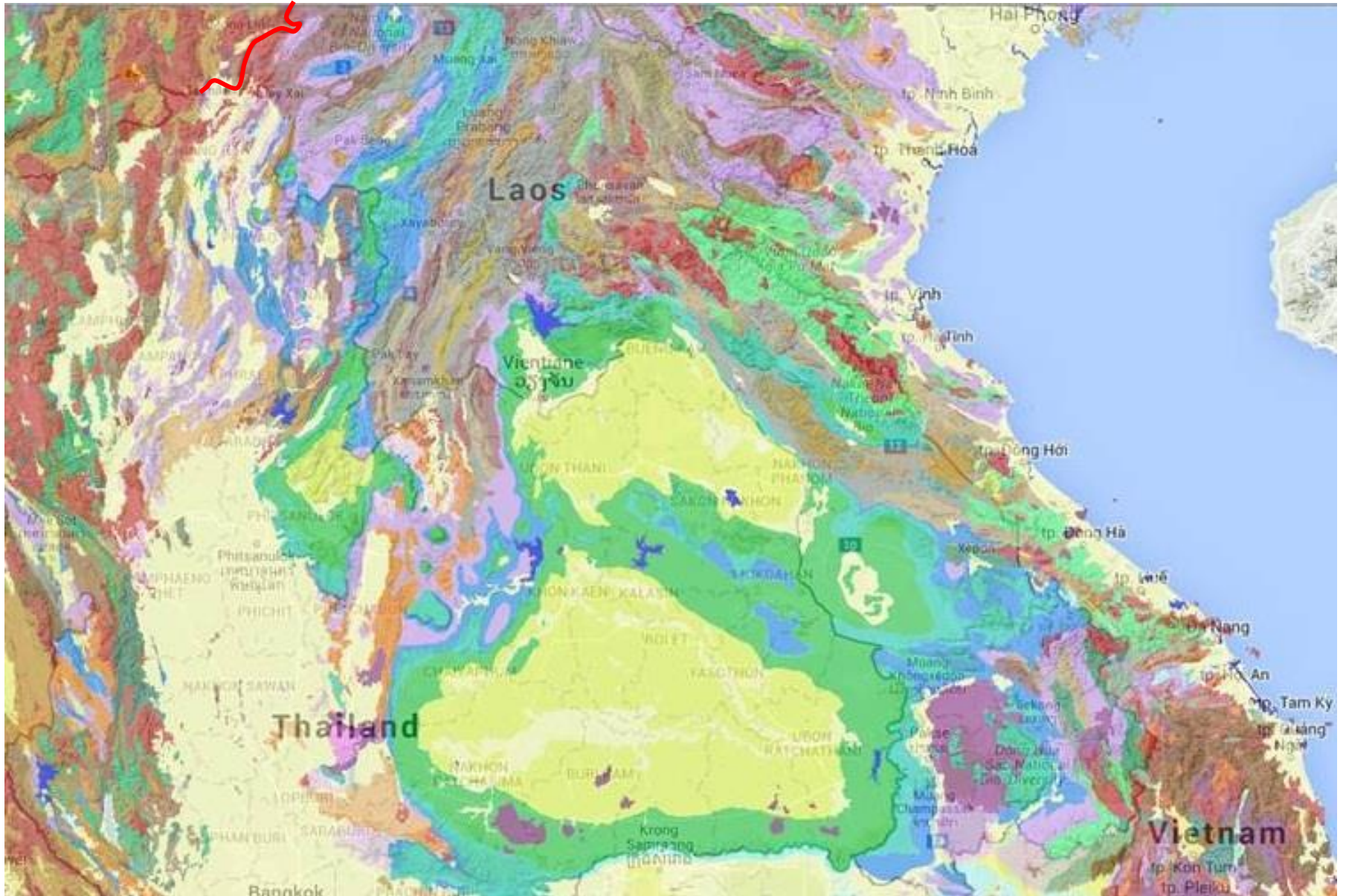
LAO PDR - CAMBODIA



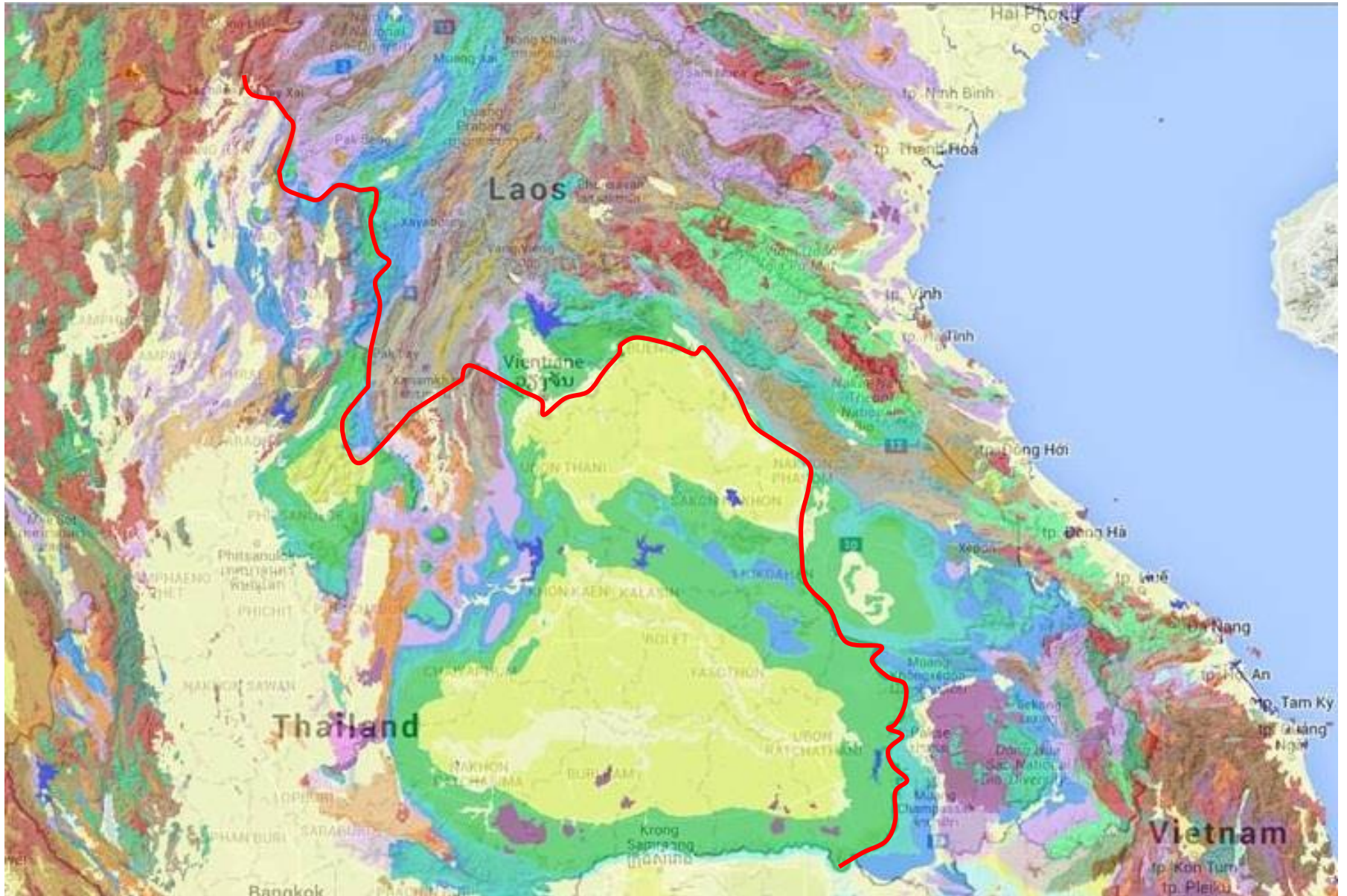
LAO PDR - VIETNAM



LAO PDR - MYANMAR



LAO PDR - THAILAND





THANK YOU