WATER QUALITY AND MINING: PART A: AN OVERVIEW OF CHEMICAL MINING HAZARDS

The material presented here has been prepared by George Wilson in April 2021, with input from Dr. Laura Richards and Prof. David Polya of the Department of Earth & Environmental Sciences, The University of Manchester, and other sources as acknowledged. The associated video recordings have been made by George Wilson.

The Transformation by Innovation in Distance Education (TIDE) project is enhancing distance learning in Myanmar by building the capacity of Higher Education staff and students, enhancing programmes of study, and strengthening systems that support Higher Educational Institutions in Myanmar. TIDE is part of the UK-Aid-funded Strategic Partnerships for Higher Education Innovation and Reform (SPHEIR) programme (www.spheir.org.uk). SPHEIR is managed on behalf of FCDO by a consortium led by the British Council that includes PwC and Universities UK International. The TIDE project will close in May 2021.

Chemical mining hazards

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Introduction

- Hazardous mining activity constitutes a major health risk to miners, local communities and the environment worldwide
- Mercury and cyanide are particularly damaging chemicals, with often little awareness of exposure pathways (Pact, 2018)

Objectives

- Become aware of the predominant types of mining in Myanmar
- Recognize that mining can severely affect water quality in Myanmar, particularly through ‘cyanidation’ and ‘amalgamation’
- Recognize chemical mining hazards in other parts of the world

MINING IN MYANMAR

Myanmar economic geology

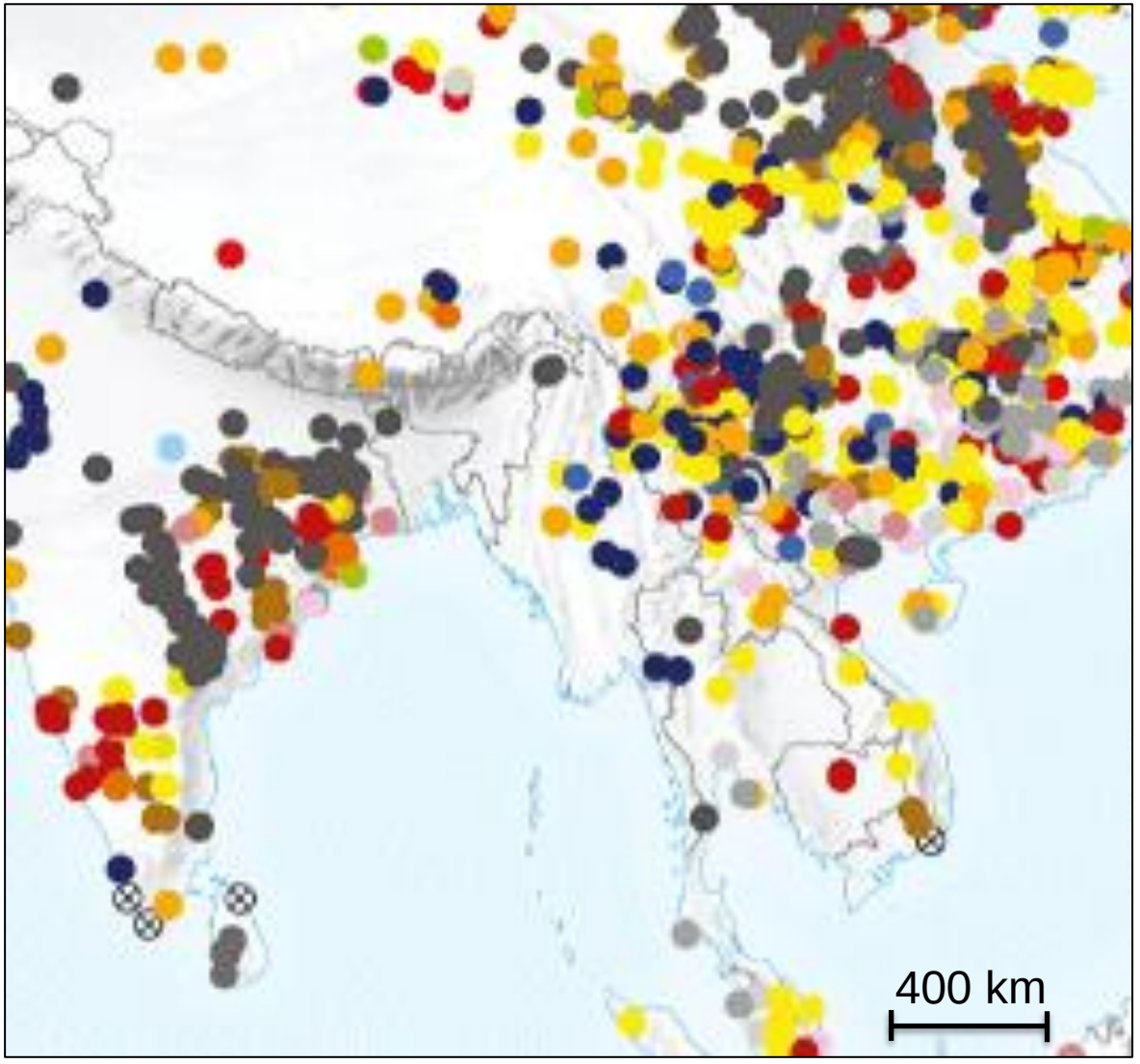
- Myanmar hosts a unique display of geology - economic resources include tungsten, copper, gold, silver, nickel and precious stones
- Mining contributes one trillion MMK/year to the GDP of Myanmar (Statista, 2021)

Active mining sites - Myanmar

TIDE

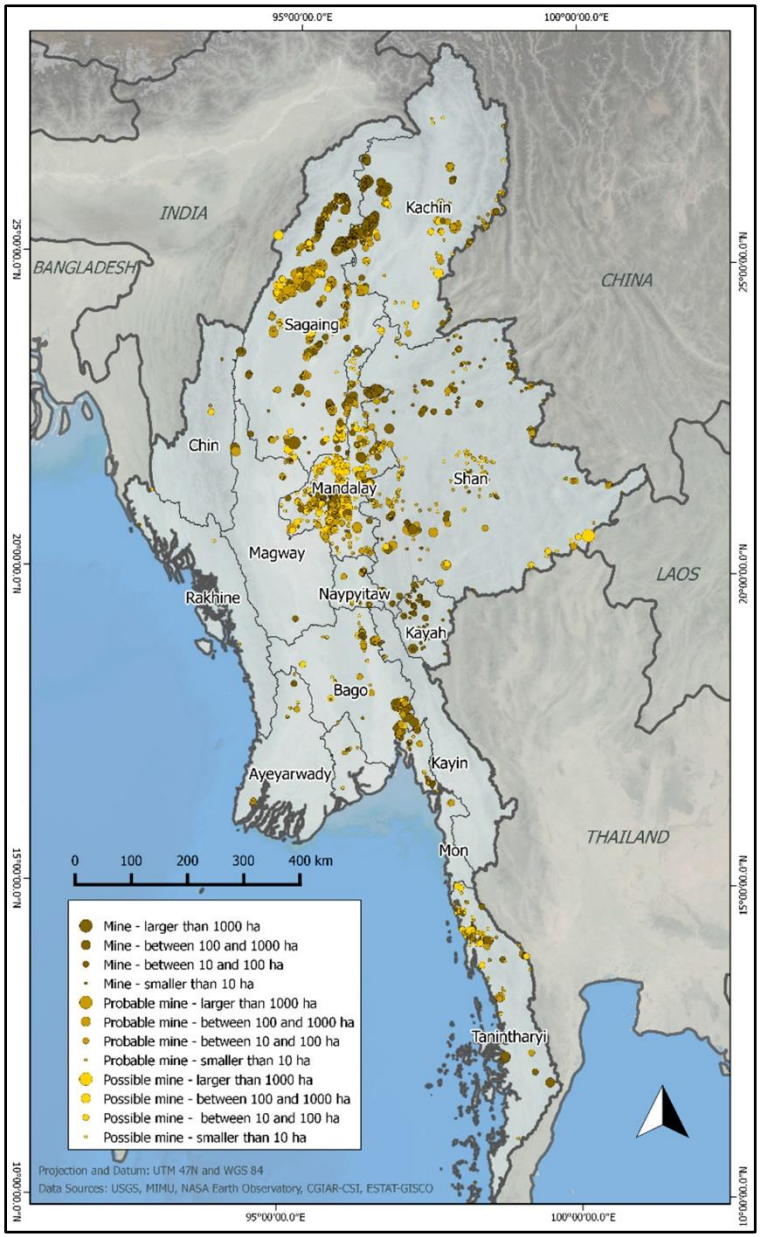
MANCHESTER 1824
The University of Manchester

Major industrial mines only

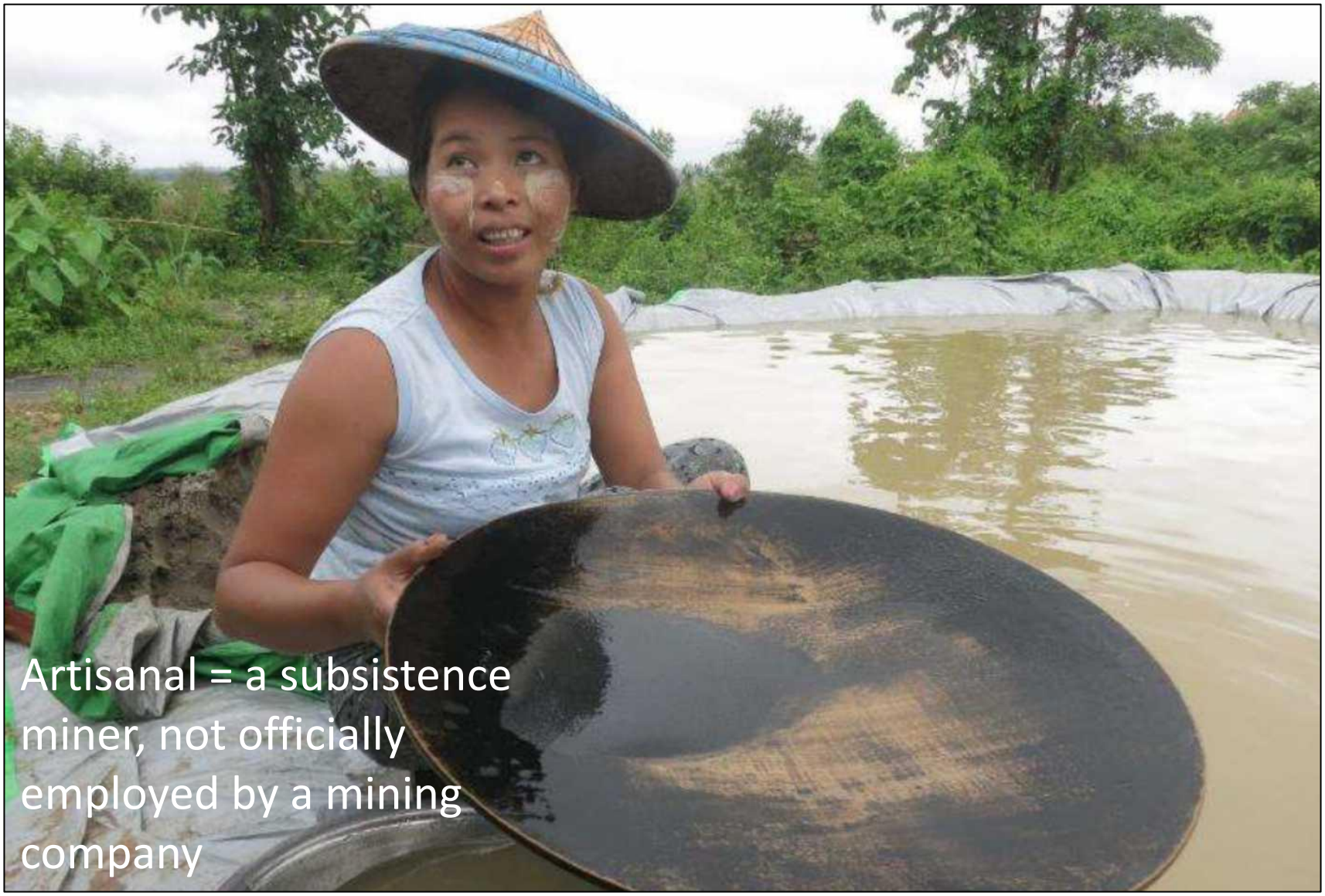


Active mining sites - Myanmar

(Mine identification based on satellite imagery)



Artisanal mining in Myanmar



Gold mining in Myanmar

Two primary extraction methods:

- Hard rock deposits – access through shafts, rock processed by cyanide (CN)

- Alluvial gold deposits – suction dredging or truck-and-shovel, mercury (Hg) amalgamates with gold to help recover finer particles that would otherwise be lost

GOLD MINING HAZARDS: CYANIDE AND MERCURY

Mercury (Hg)

- Metal mercury ⟶ methylmercury (converted by micro-organisms)

1 Elemental and methylmercury toxic to central and peripheral nervous systems

2 Inhalation of mercury vapour induces neurological and behavioral issues

3 Toxicity and bioaccumulation in the environment

…

(WHO, 2017)

Cyanide (CN^-)

- Rapidly absorbed through the skin and respiratory membranes

1 Depression of the nervous system which may result in respiratory arrest and death

2 Degrades rapidly although cyanate and thiocyanate (breakdown products) also toxic

…

(CDC, 2008)

Hg and CN^- use in Myanmar

- Increases revenue and yield
- Both banned in commercial mining contracts
- Used in local mining projects; authorities refrain from intervening

(National Resource Governance Institute, 2015)

OTHER CHEMICAL MINING HAZARDS

Chemical mining hazards

Mining activity	Chemical	Hazard posed by chemical
Mining of rock	Crystalline silica / coal dust; diesel	Chronic obstructive pulmonary disease; carcinogen
Exploration drilling – analysis of core samples	Hydrofluoric acid	Causes severe burns, causes cardiac arrest
Extraction through leaching	Sulfuric acid	Causes severe burns
Smelting of sulphide ores	Sulfur dioxide; arsenic	Acute bronchospasm; lung cancer
Smelting of aluminium ores	Coal tar pitch volatiles	Lung and bladder cancer

(Donoghue, 2019)

SUMMARY

Summary

- Myanmar is very rich in mineral resources due to its unique geology
- Awareness of mercury and cyanide risks important to the half million artisanal workers in Myanmar
- Other chemical hazards arise from rock dusts, hydrofluoric acid and the products of ore smelting

LEARNING EXERCISE

Learning exercise

1. Describe three chemical hazards that could be associated with mining gold.
2. Suggest/research an alternative method to mercury amalgamation that artisanal gold miners may use to retrieve gold

REFERENCES & FURTHER RESOURCES

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Further Resources

Alternative methods to using mercury in mining practices

EPA, 2018. Artisanal and Small-Scale Gold Mining Without Mercury. [Online] Available at: https://www.epa.gov/international-cooperation/artisanal-and-small-scale-gold-mining-without-mercury (OA)

Mining chemical hazards

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