British Geological Survey
NATURAL ENVIRONMENT RESEARCH COUNCIL

High-purity limestone in the UAE

Clive Mitchell
Industrial Minerals Specialist
British Geological Survey

Outline of presentation

- What is high-purity limestone
- Reconnaissance assessment
- Limestone purity classification
- High-purity limestone in the UAE
- Where to get maps and reports
- Conclusions

British Geological Survey (BGS)

- BGS is a world-leading survey focussing on public-good science & research to understand earth & environment
- Annual budget of £50 million
- 640 staff, of which 520 scientists
- 20 science laboratories
- 150 private-sector clients
- Vision, a global geological survey using new technology and data to understand and predict the geological processes that matter to peoples lives and livelihoods

High-purity limestone

- Limestone occurs as Sedimentary (limestone, chalk, travertine, vein & marl), Metamorphic (marble) & Igneous (carbonatite) rocks
- Limestone has more uses than any other industrial minerals
- Low value, bulk volume construction material (e.g. aggregate, ballast, dimension stone) or High value, lower volume speciality mineral (e.g. GCC & PCC, Ground & Precipitated Calcium Carbonate)
- High-purity limestone (>97% $CaCO_3$, Calcium Carbonate) used for lime, glass, metallurgical flux, FGD, sugar refining, mineral fillers (GCC & PCC) and calcium chemicals
- Suitability defined by industrial end-use
- Chemical, mineralogical & physical properties
- Assessment is guided by industrial requirements

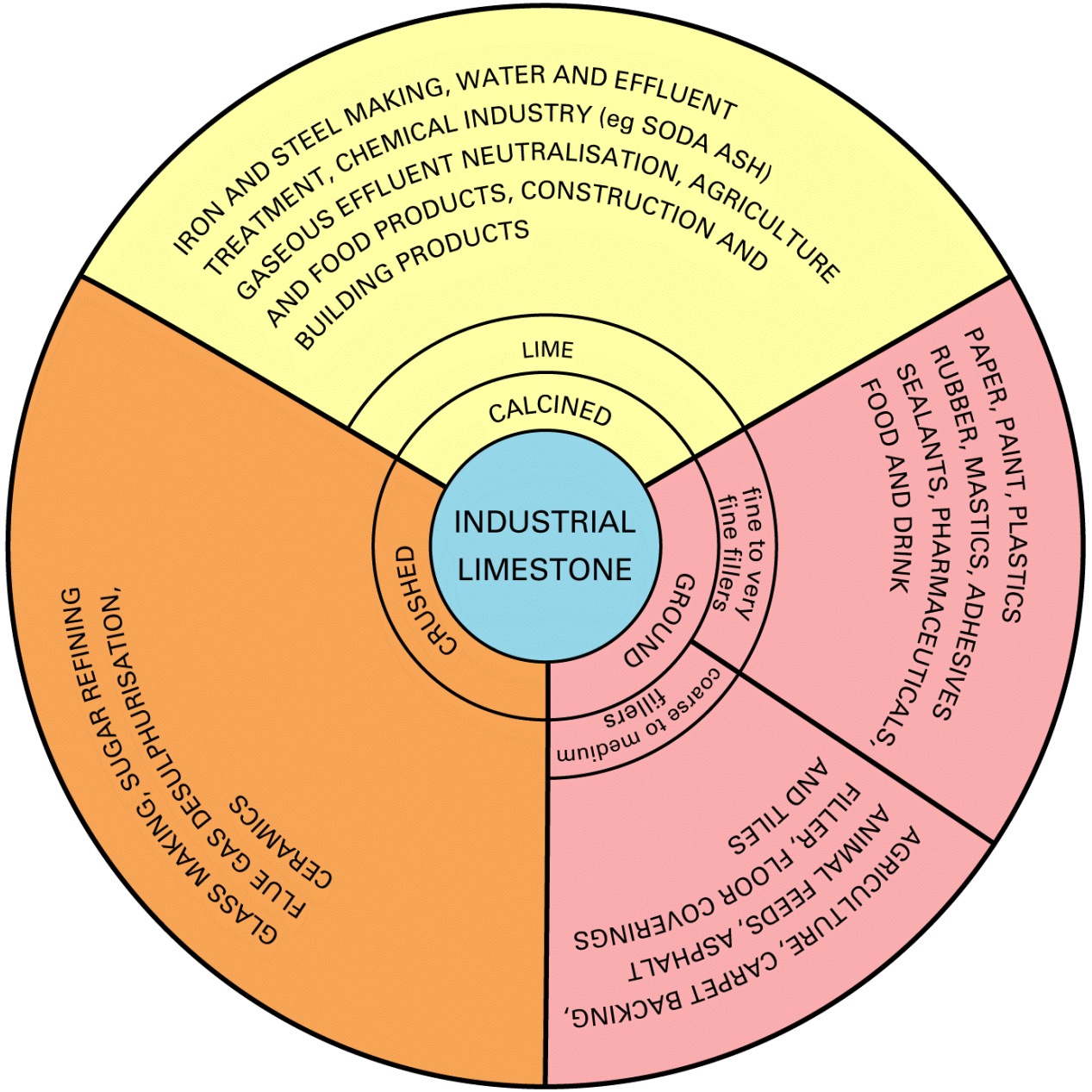

NATIONAL
PAINTS
S. GALLON


JEBEL ALI CONTAINER GLASS FACTORY
EMIRATES GAS

Chemical composition

Oxide	Wt %	Oxide	Wt %	Oxide	Wt %
SiO_2	<2.0	Na_2O	<0.1	BaO	<0.1
TiO_2	<0.1	K_2O	<0.1	NiO	<0.1
Al_2O_3	<0.3	P_2O_5	<0.1	CuO	<0.1
Fe_2O_3	<1.0	SO_3	<0.5	ZnO	<0.1
Mn_3O_4	<0.1	Cr_2O_3	<0.1	PbO	<0.1
MgO	<3.0	SrO	<0.2	LOI	>42.7
CaO	>54.3	ZrO_2	<0.1	Total	100.0

Typical chemical composition of high-purity limestone; standard range of major element oxides analysed by XRF at BGS.



Planning

- High-purity resources in ‘low-grade’ uses is an issue
  e.g. Carboniferous limestone in the UK used as speciality mineral and construction aggregate
- Many consider this an inefficient use of resources
- Strategic value of high-purity resources
- UK ‘Mineral Safeguarding Areas’, avoid sterilisation
- Competing land use with other environmental designations
  e.g. National Parks & AONBs

Reconnaissance exploration

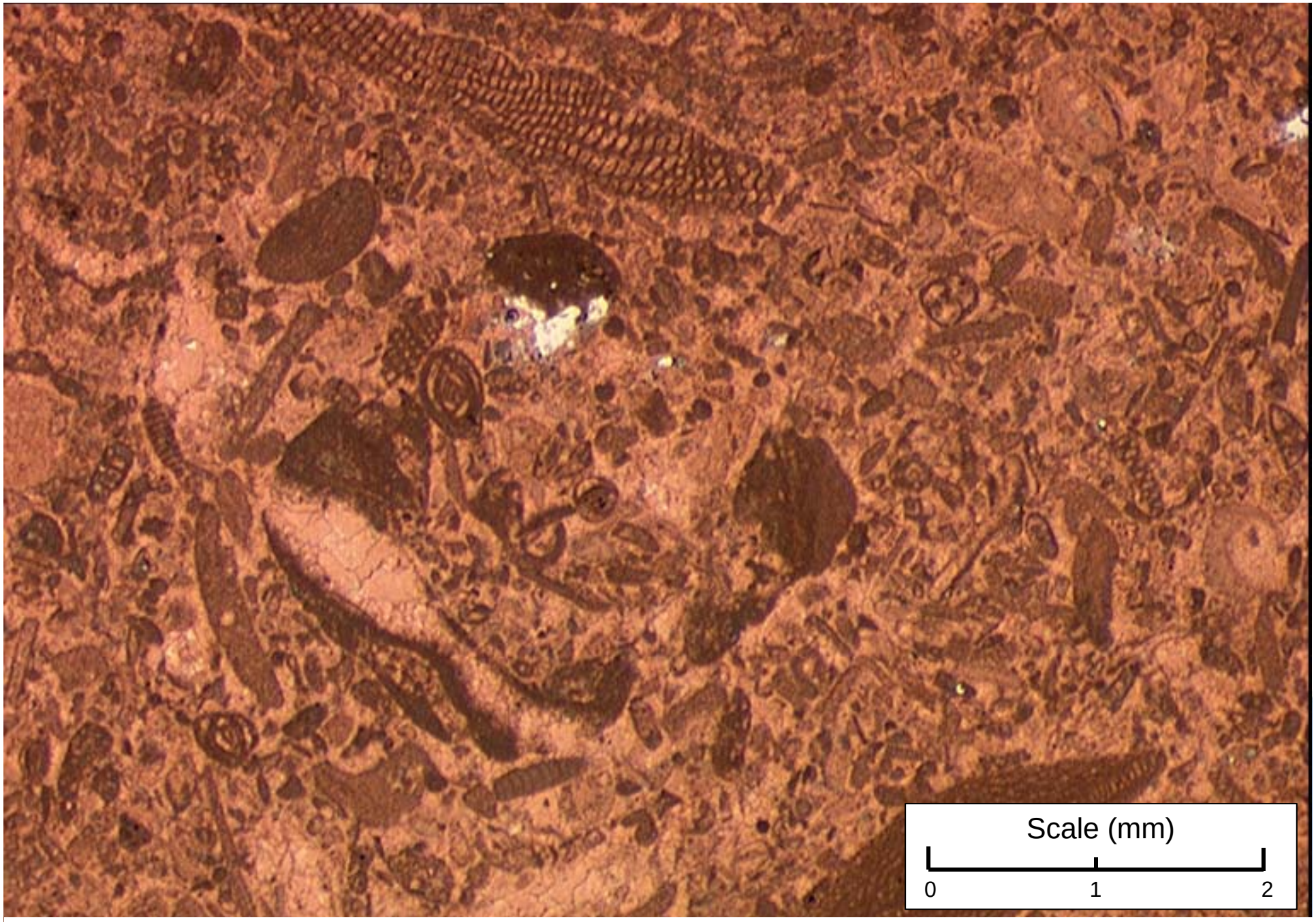
- National Geosurvey explore at national/ regional scale, starting with existing geological information
- Prioritisation of potential high-purity resources using GIS maps & then field work to collect samples
- Technical testing by Chemical analysis (XRF), Mineralogical analysis (XRD and petrography), and Physical property testing (e.g. whiteness)
- Mineral impurities include other carbonate minerals (dolomite, siderite), Silica (quartz, chert), Clay minerals (kaolinite, illite, smectite), Mineralisation (fluorite, galena, sphalerite) and others (organic matter,pyrite, iron oxides, etc…)

Sampling limestone in Zambia (2000) and Afghanistan (2007)

Laboratory Testwork

Limestone purity classification

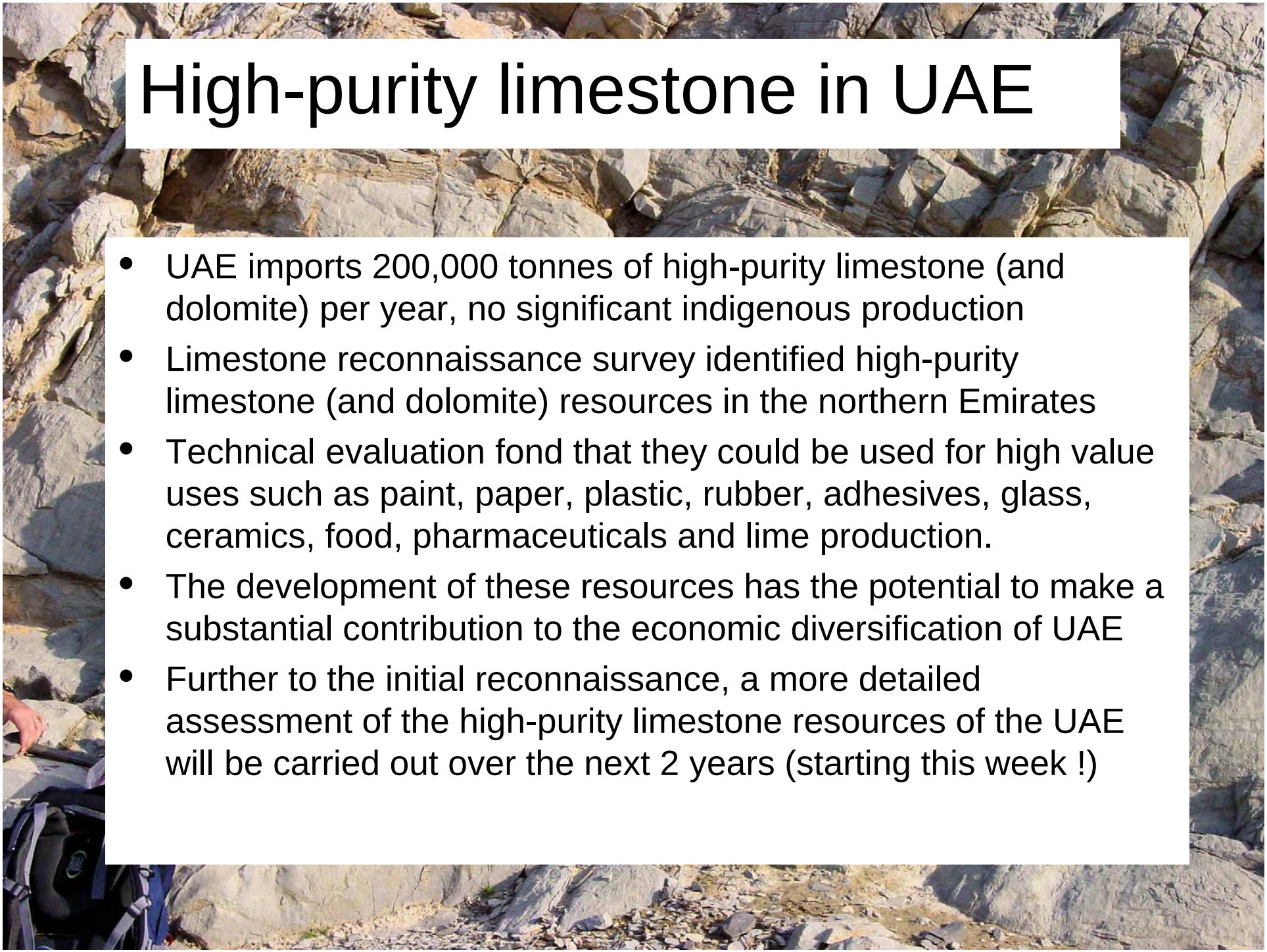
Limestone classification	**CaO** (wt%)	**$CaCO_3$** (wt %)	**MgO** (wt%)	**SiO_2** (wt%)	**Fe_2O_3** (wt%)
Very high purity	> 55.2	> 98.5	< 0.8	< 0.2	< 0.05
High purity	54.3 - 55.2	97.0 - 98.5	< 1.0	< 0.6	< 0.1
Medium purity	52.4 - 54.3	93.5 - 97.0	< 3.0	< 1.0	< 1.0
Low purity	47.6 - 52.4	85.0 - 93.5	> 3.0	< 2.0	> 1.0
Impure	< 47.6	< 85.0		> 2.0	



Petrographic photomicrograph of limestone from the UAE

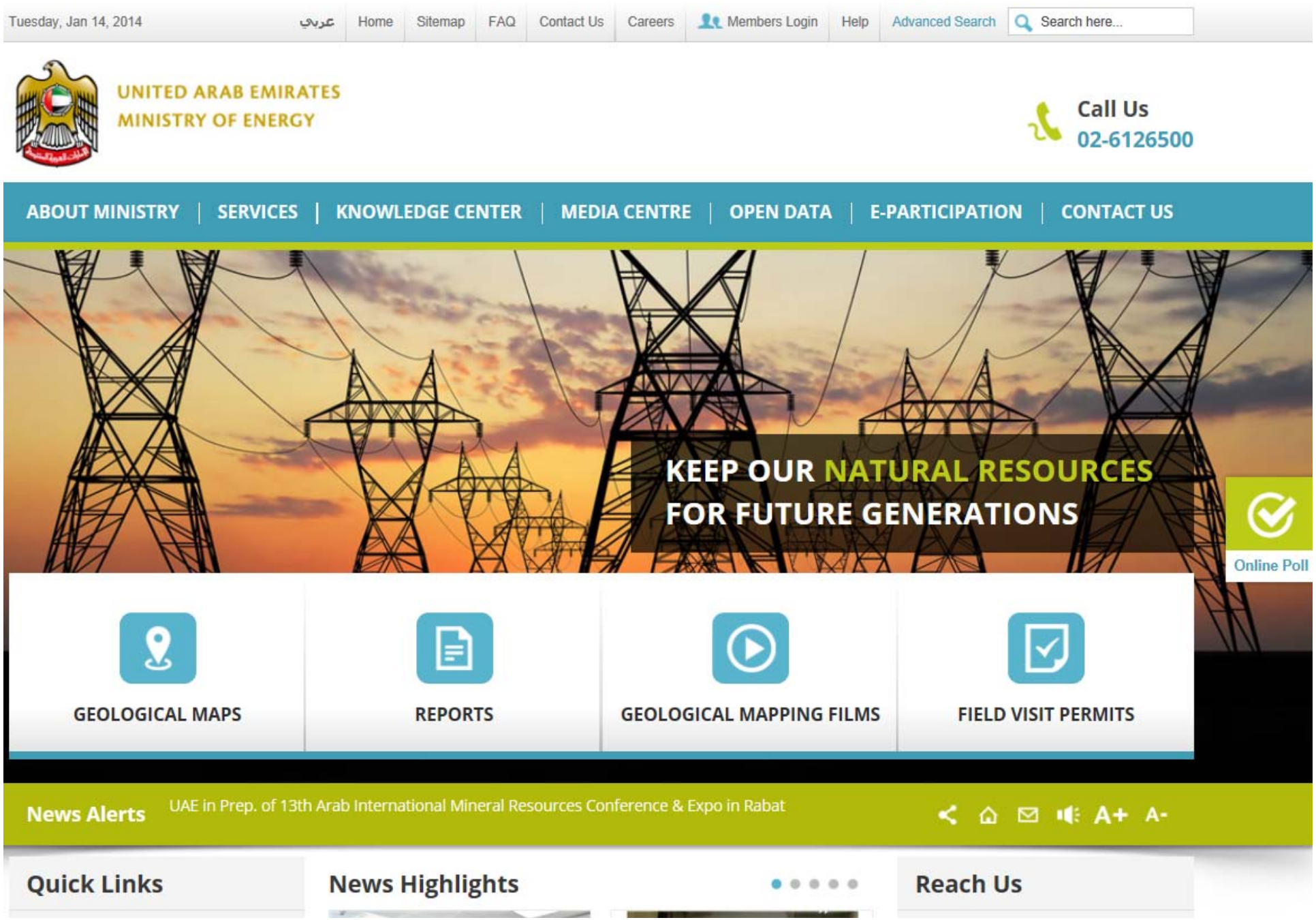
Sampling limestone in UAE (2009 - 2010)

Sampling limestone in UAE (2009 - 2010)



High-purity limestone in UAE

- UAE imports 200,000 tonnes of high-purity limestone (and dolomite) per year, no significant indigenous production
- Limestone reconnaissance survey identified high-purity limestone (and dolomite) resources in the northern Emirates
- Technical evaluation fond that they could be used for high value uses such as paint, paper, plastic, rubber, adhesives, glass, ceramics, food, pharmaceuticals and lime production.
- The development of these resources has the potential to make a substantial contribution to the economic diversification of UAE
- Further to the initial reconnaissance, a more detailed assessment of the high-purity limestone resources of the UAE will be carried out over the next 2 years (starting this week !)

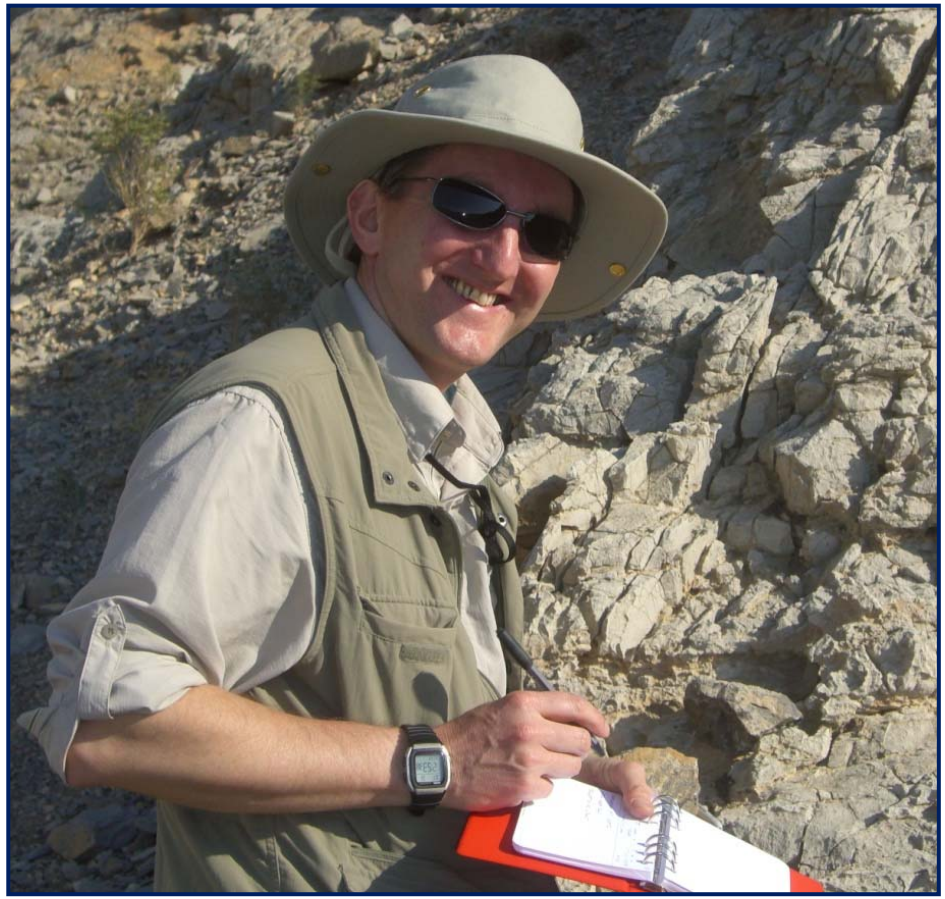


UAE Ministry of Energy website : www.moenr.gov.ae

Conclusions

- Limestone resources are often widespread
- National Geosurveys work at reconnaissance scale
- Technical assessment needs market information
- Ongoing challenge to maintain knowledge base
- Laboratory capabilities a key component
- UAE limestone reports and maps available via the Ministry of Energy website (http://www.moenr.gov.ae/portal/en/home.aspx)

Thank you for your attention



Clive Mitchell

Industrial Minerals Specialist

British Geological Survey

Keyworth, Nottingham, NG12 5GG

United Kingdom (UK)

Tel. +44 (0)115 936 3257

Email: cjmi@bgs.ac.uk

Web: www.mineralsuk.com

Twitter: @CliveBGS