



GEOINŽENIRING d.o.o.
Dimičeva 14, Ljubljana

Tehnologija zajema in skladiščenja CO₂ (CCS)

3. Lastnosti CO₂ in njegova prisotnost v naravnem okolju

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predstavitev v okviru predmeta Okoljska geologija

UL - NTF, oddelek za geologijo

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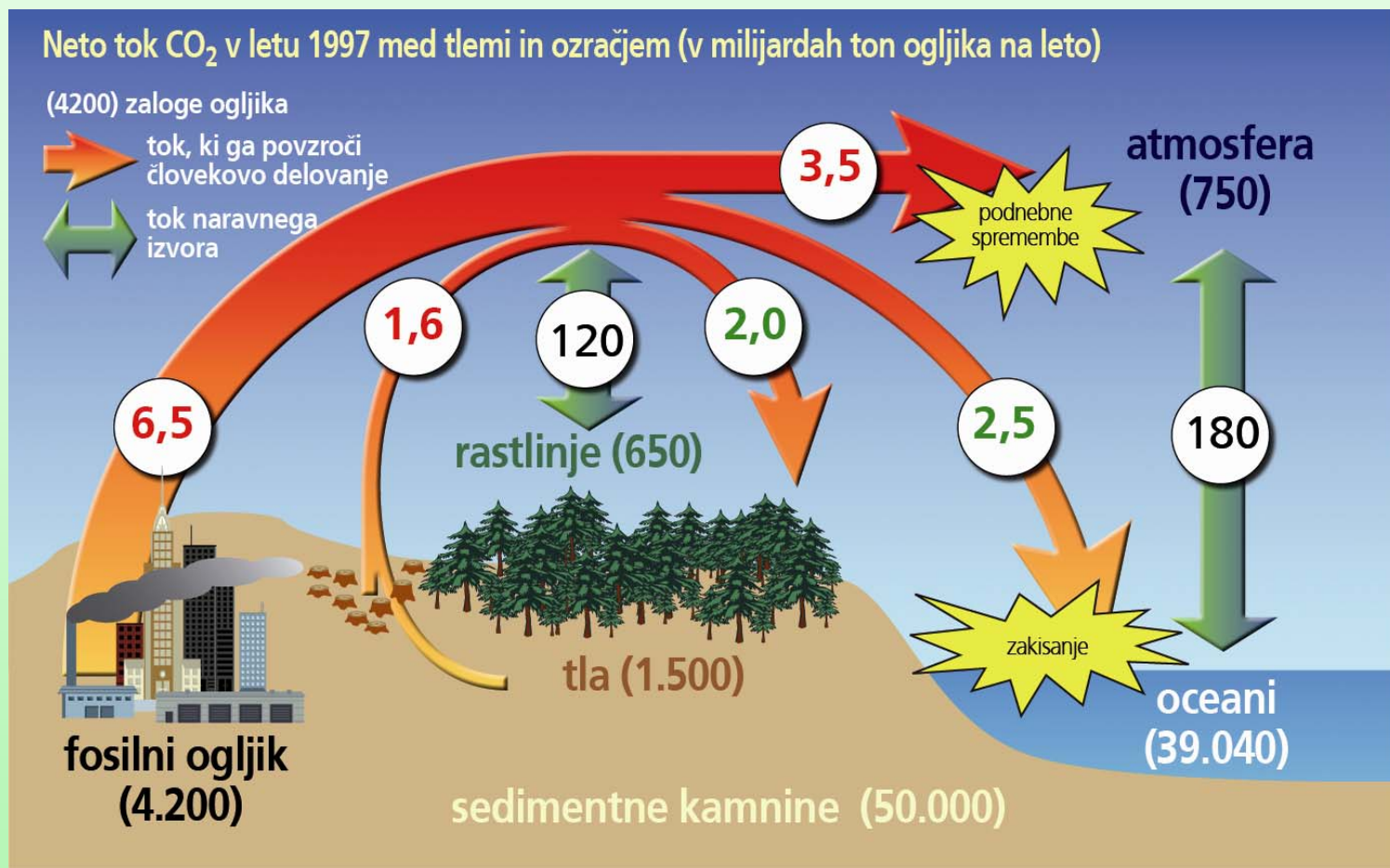
Geoinženiring

Vsebina predstavitve:

- Lastnosti CO₂
- Prisotnost CO₂ v naravnem okolju
- Preučevanje naravnih analogov
- Uporaba CO₂ v vsakdanjem življenju



Kroženje CO₂ med tlemi in ozračjem

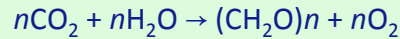


antropogeni CO₂ - polovico vsrka rastlinje oz. se raztopi v oceanih, polovico pa gre v ozračje

Lastnosti CO₂ - prisotnost v naravnem okolju

cellular respiration (photosynthesis)

plants absorb CO₂ from the air and together with water form carbohydrates:

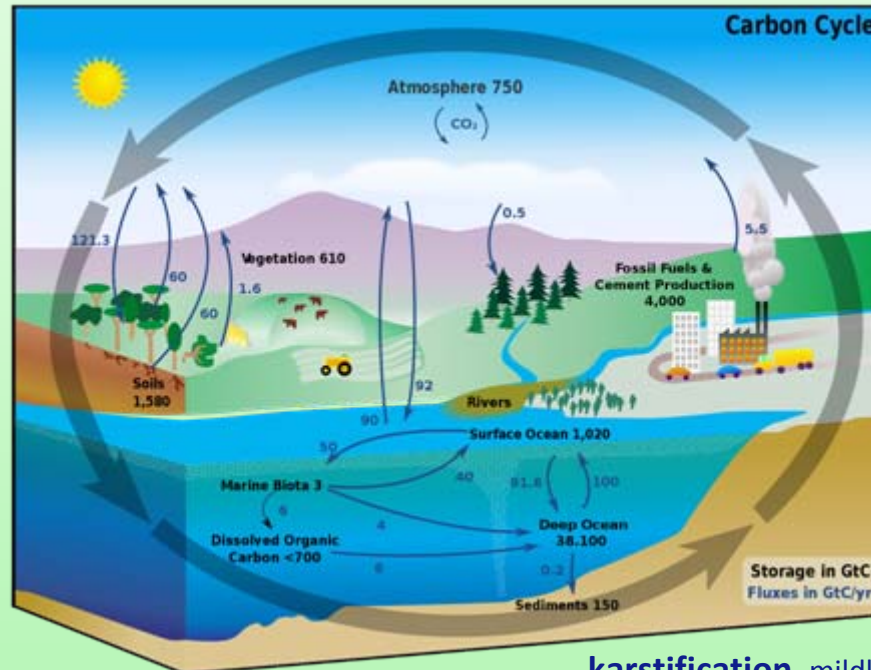


animal & human breathing

respiratory gas exchange

carbon fixation in

- carbonate sedimentary rocks (calcite, dolomite, siderite...)
- organic limestones (Reef l., Foraminiferal l., Chalk ...)
- chemical limestones (dolomite, calc tufa ...)
- clastic rocks

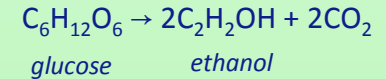


fermentation

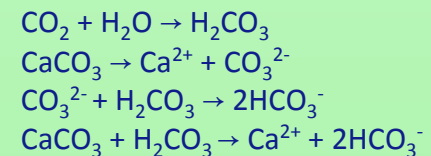
in food processing carbohydrates are converted to alcohols and CO₂ or organic acids applying yeasts and/or bacteria under anaerobic conditions;

typical example:

sugar is converted to ethanol;
(wine, beer, sparkling wine, cider etc.)



karstification mildly acidic water dissolves carbonates, particularly along fractures, beddings; over time underground drainage system develops:



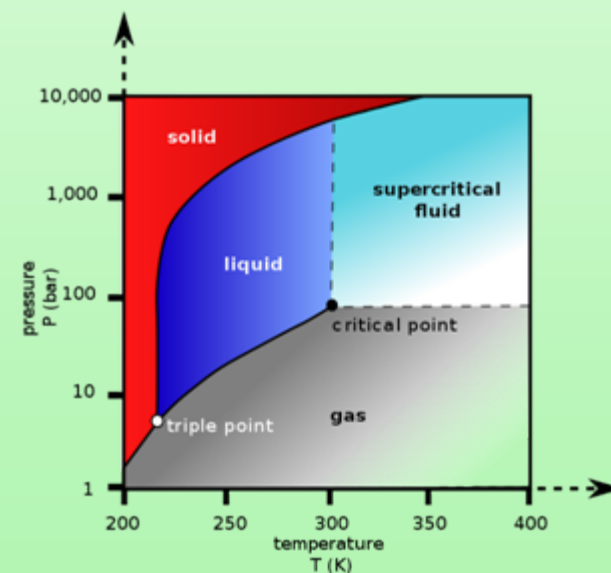
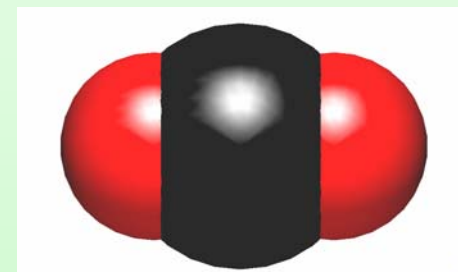
emitted by volcanoes, hot water springs, geysers



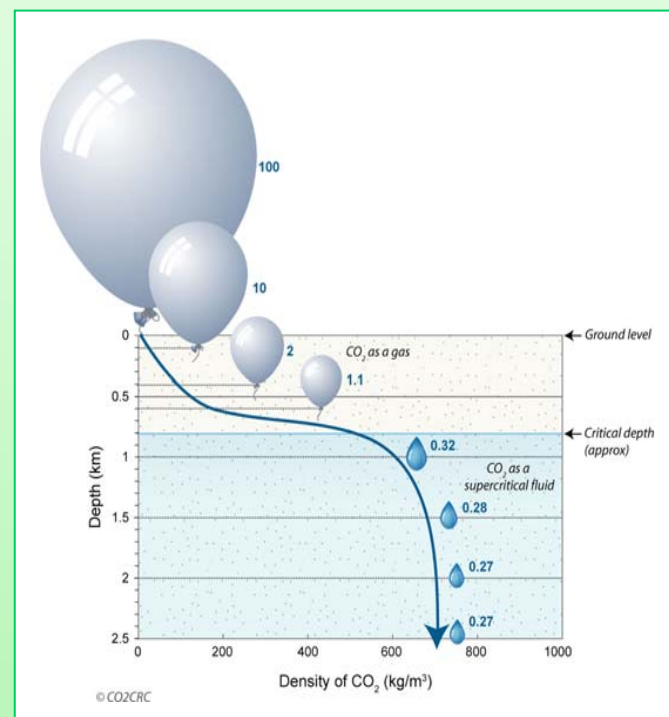
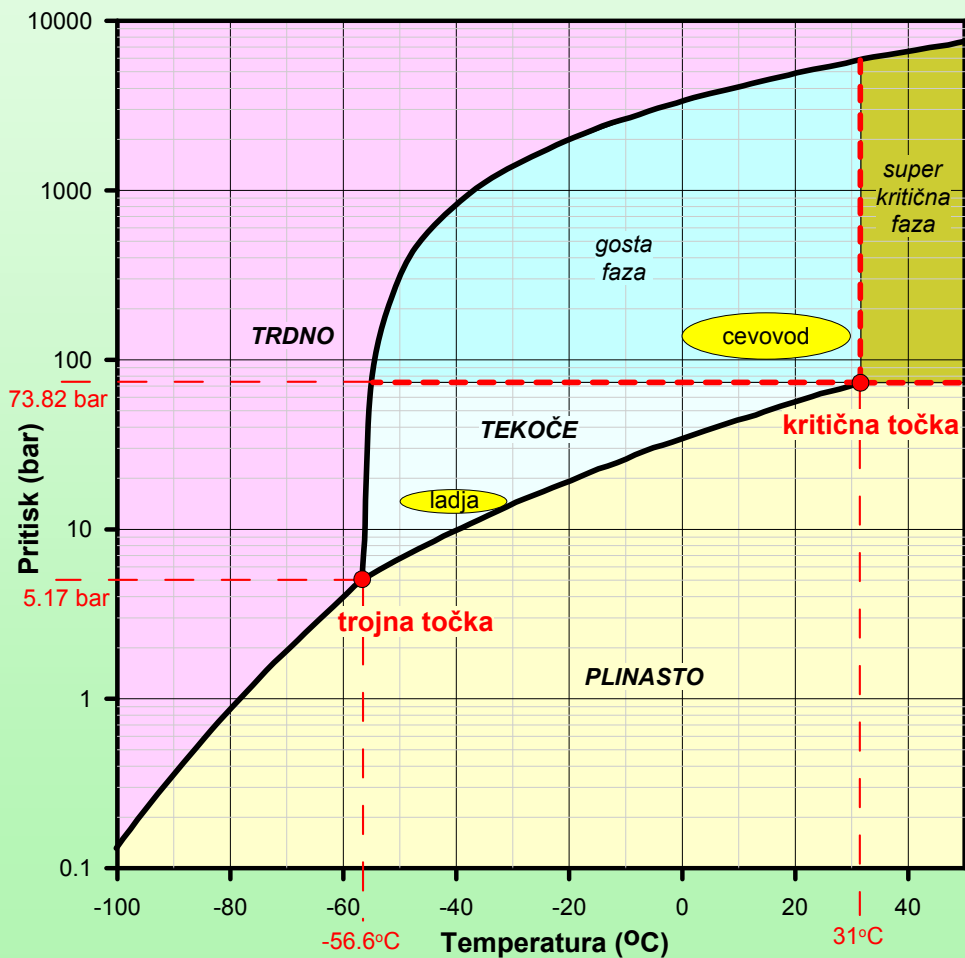
Lastnosti CO₂

Kemijske in fizikalne lastnosti CO₂:

- specifično obnašanje glede na pojavno fazo (plinsko, tekoče, trdno stanje)
- brez barve in vonja (ob večjih koncentracijah kiselkast vonj)
- 1.5 krat težji od zraka (1.98 g/m³ pri 1bar, 78°C)
- prepušča vidno svetlobo, absorbira infrardečo svetlobo
- topen v vodi
- polno oksidiran (nizka reaktivnost, nevnetljiv)
- brez električnega dipola (linearno simetrična molekula, celotni dipolni moment nič)
- sublimira (1 bar, nad -78°C)
- visoka volumska hladilna kapaciteta

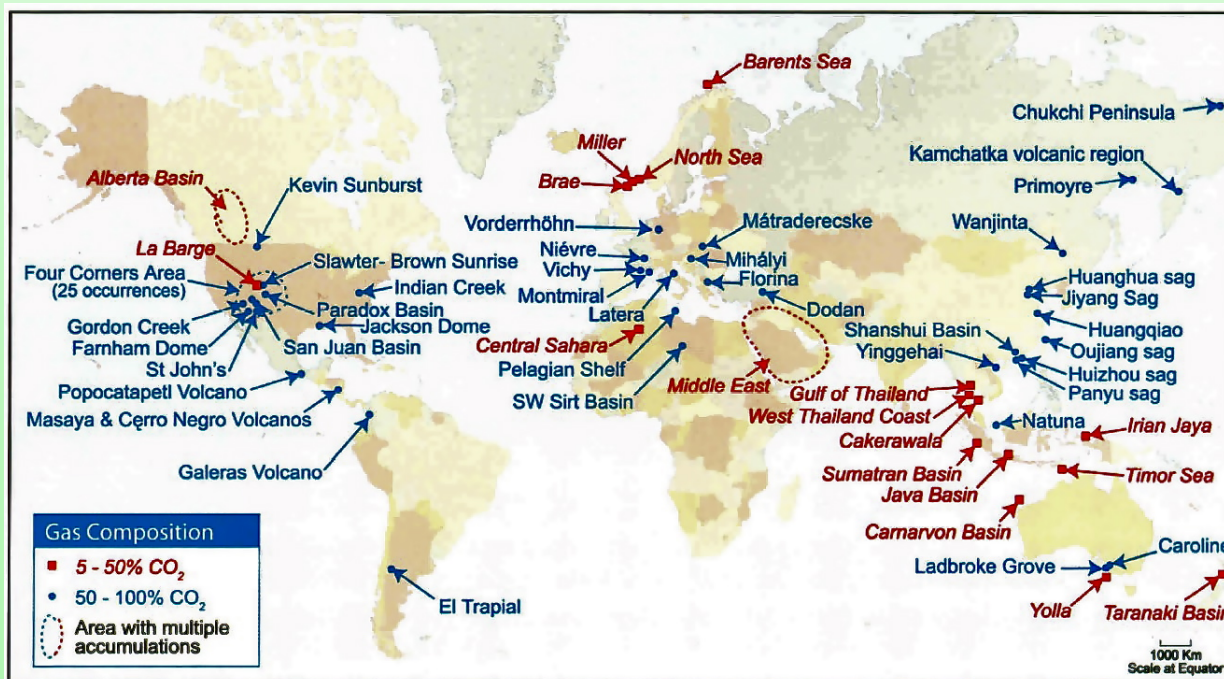


Lastnosti CO₂ – optimalni pogoji za transport in geološko skladiščenje



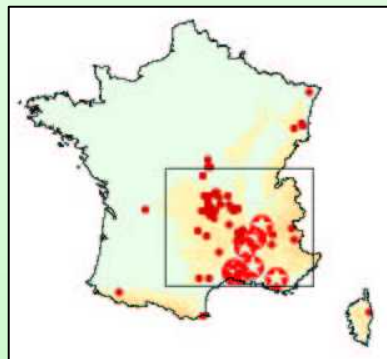
Preučevanje naravnih analogov

vir naravnega izhajanje CO₂ na površini

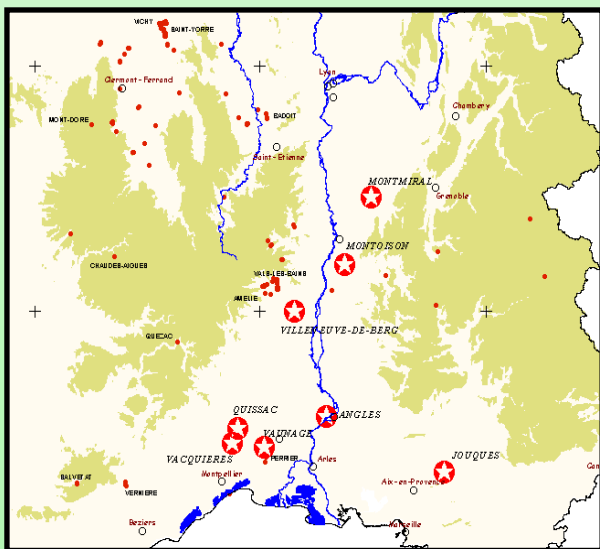


vir: IPCC

Preučevanje naravnih analogov



študij lokacij naravnega izhajanja CO₂ za modeliranje in napovedovanje procesov pri skladiščenju



Gas vent at Larderello caldera



vir: NASCENT, CO2GEONET

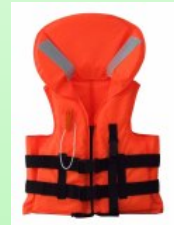


Lastnosti CO₂ – CO₂ kot surovina

(1/2)

(prirejeno po Wikipedii)

- **food industry**
 - preservative
(grain containers, food oils & fats, for atmosphere modification etc.)
 - cooling agent (ice cream, frozen food etc.)
 - leaving agent (baking powder, baking soda)
 - beverage production
(soft drinks, beer, sparkling wine, carbonated mineral water, etc.)
 - wine making process (fermentation inhibitor, cooling, etc.)
- **blast cleaning** (cleaning of machines and processing equipment - dry ice pellets are accelerated in a pressurized air stream and directed at a surface to be cleaned)
- **welding** (CO₂ reacts to oxidize most metals)
- **fire extinguisher**
- **products with pressurized gas** (life-jackets, airguns, tires, pneumatic systems, etc.)
- **blasting in coal mines**
- **refrigerant** (in solid & liquid phase) (liquid CO₂ has the potential to replace HFC)
(heat pumps, cooling and heating, car air conditioning, refrigerators etc.)
- **CO₂ laser** (cutting, welding, engraving, surgery)
- **transport** (shipping, etc.)



Lastnosti CO₂ – CO₂ kot surovina

(1/2)

(prirejeno po Wikipedii)

- **greenhouses** (as growth accelerator, as pesticide, in growing Spirulina algae)
- **pharmaceutical and chemical industry** (as solvent, as raw material, as catalyst etc.)
- **chemical dry cleaning**
- **laboratories** (preservation of biological samples, research etc.)
- **pH control** (swimming pools, aquaristics)
- **special applications in medicine** (skin treatment, inhalation, etc.)
- **EOR, EGR**
- **ECBM**



ZAKLJUČKI

- CO₂ sodeluje v vrsti naravnih procesov
- nestrupen, neeksploziven, nizko reaktiven
- nastopa v različnih agregatnih stanjih (specifično obnašanje)
- CO₂ naravno izhaja na površje na številnih mestih
- študij obnašanja CO₂ pod površjem na primeru naravnih analogov
- kot surovino ga uporabljamo v številnih industrijskih panogah in tehnoloških procesih

