

IVAN GAMS (\*)

## CHEMICAL DENUDATION AS A GEOMORPHIC PROCESS

ABSTRACT: GAMS I., *Chemical denudation as a geomorphic process*. (IT ISSN 0391-9838, 1998).

In the paper the discrepancy between a significant part (one-fifth to one-sixth) of solutes in total river load and the insignificant percentage of solutional landforms identified in geomorphology is treated. The abundance of data on chemical denudation in the predominant impermeable carbonates on the southern border of the Pannonian basin shows that solution is also the prevailing process there, but local erosion and soil denudation prevent the formation of proper solutional features. The solution of the noncarbonatic sediments is almost overlooked in geomorphogenetics.

The second reason for the discrepancy is that geomorphology had identified landforms before sufficient knowledge on solutes accumulation. Some measurements of water chemistry have shown the solution to be an additional process, not only in blind valleys and allogenic caves, but also in through valleys previously regarded as solely erosional or/and glacial landforms.

KEY WORDS: Chemical denudation, Solutional landforms, Pannonian basin.

RIASSUNTO: GAMS I., *La dissoluzione chimica come processo geomorfologico*. (IT ISSN 0391-9838, 1998).

Nell'articolo si tratta della discrepanza fra la realtà dell'esistenza di una parte significativa (da 1/5 a 1/6) di sostanze disciolte sul totale del carico dei fiumi e la insignificante percentuale di forme dovute ai processi di dissoluzione identificate in geomorfologia. L'abbondanza di dati sulla denudazione chimica nei carbonati impermeabili al bordo meridionale del Bacino Pannonico mostra che la dissoluzione è il principale processo geomorfologico, ma l'erosione e il denudamento del suolo prevengono la formazione di forme proprie da dissoluzione. La dissoluzione dei sedimenti diversi dai carbonati è forse sovrastimata in geomorfologia.

La seconda ragione della discrepanza, cui si è accennato all'inizio, è che la scienza geomorfologica ha identificato le forme del paesaggio prima di aver avuto una conoscenza di base sufficiente sull'accumulo dei prodotti della dissoluzione. Alcune misure idrochimiche hanno mostrato invece che la dissoluzione può essere un processo aggiuntivo agli altri, non soltanto nelle valli cicche o nelle grotte, ma anche nelle valli trasversali in precedenza interpretate come esclusivamente dovute a erosioni o ai processi glaciali.

TERMINI CHIAVE: Dissoluzione chimica, Forme di dissoluzione, Bacino Pannonico.

(\*) Department of Geography, University of Ljubljana, P.P. 323-1001 Ljubljana, Slovenia.

### KARST MORPHOLOGY

Since the 1950s, detailed and systematic measurements of so-called chemical denudation (also called solutional denudation, chemical erosion, corrosion) have been performed in karst areas. At first, chemical erosion seemed easier to detect than other processes. It is necessary to establish the average «minirelisation» of water in a river, multiply its weight by discharge and then distribute the calculated solute load over the river basin. Discharge is usually expressed in l/km<sup>2</sup>/sec as reported by national or regional hydrological service. Solute load is given in mg/l and tonnes per sq km in one year, or in mm in thousand years. There are many formulae for calculation (reviewed by Ford & Williams, 1989, pp. 106-109).

Thirty years ago chemical denudation was studied in the 23 river basins of the Slovenian Dinaric and Alpine karst built of permeable limestone and dolomite (Gams, 1962, 1967, 1972, 1982). It was found that, besides lithology, runoff is the most important factor - as opposed to air temperature as claimed in many contemporary textbooks. This contradicts the supposition that there was a greater chemical solution in warmer Tertiary climates than at present in the temperate zone, assumed only on the basis of higher temperatures. The same study found no correlation between chemical denudation expressed in m<sup>3</sup>/km<sup>2</sup>/y of dissolved limestone and dolomite and the stage of karstification expressed in percentage of karst depressions on the surface (Gams, 1966, 1980). Almost the same rate of chemical denudation as in limestone and dolomite was found for «fluviokarsts» built of dolomite (with nearly one half in MgCO<sub>3</sub>), virtually free of karst depressions. In one such river basin (Temenica river, Slovenia) solute amounts slightly exceed suspended load (Šali, 1969). In a nearby larger river (Krka), draining mostly limestone areas, solute transport greatly exceeds that of solids. This applies to