Petrographical and geochemical characteristics of metacarbonates in the Bozdag Formation, northwest Konya, Central Turkey

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Introduction The study area is located between Yükselen-Osmancik and Kadinhani towns, about 40 km northwest of Konya. The area is included in the Afyon-Bolkardagi Zone (Okay, 1984), or in the Kütahya-Bolkardag belt (Özcan *et al.*, 1988). Bozdag formation was first named by Dogan (1975) and its general field descriptions were reported by Eren (1993) and Kurt (1994). Bozdag formation, which can be observed as various shaped and isolated masses, include different grade metamorphosed limestone, dolomitic limestone and dolomite. The limestone is light grey, white in colour and generally massive to medium bedded (10–50 cm). The dolomite and dolomitic limestone are medium to thick bedded, black and dark grey in colour, which caused by very high contents of bituminous, and insoluble residue. They show very fine lamination and comprise widespread biostromes of Amphipora. When broken, all the dolomite and dolomitic limestone regardless of colour, give off a strong, petroliferous odour. The rocks of this formation, which metachert beds and chert lenses generally occurs in metacarbonate, are interfingering with each other laterally and vertically.

The metacarbonate rocks contain corals, which are Thamnopora, Syringopora and Canina, Stromatoporoid which is Amphipora, crinoids, fusulinide and algae. These fossils indicate a middle Devonian and early Carboniferous age for the formation. Otherwise the formation contains an abundant microfauna which is difficult to identify, due to metamorphism and recrystallization. These metacarbonates are cut by intrusive dykes and active volcanism and metasedimentary rocks also recorded in the surrounding area (Eren, 1993; Kurt, 1994).

The aim of this research is to investigate the petrography and geochemistry of the metacarbonate rocks studied.

Mineral identifications were made optically by X-ray diffraction methods. An analysis of major and trace elements was made by the X-ray fluorescence.

Petrography The light coloured metacarbonate is composed of micrite cement, calcite, dolomite, biomicrite, coral and Fe-oxide. The calcite grain boundaries are sutured and are fragmented and set in a secondary calcite cement. Some coarse calcite crystals show deformation twinning, kinking and inclusion trails. The grain size distribution is unimodal. An abundance of such twinned lenses characterises as the twinning regime. Very small calcite grains are found mainly in the groundmass, but sometimes fill fossil cavities. Noncarbonate minerals accumulated along stylolites as insoluble residues, these residues also form the boundaries of veins, and this relationship indicates that some veins formed by void filling after formation of stylolite. Insoluble residues contain iron oxides, organic materials and sericite. The rocks show laminated zones and mosaic textures.

Dark coloured, bituminous and partly dolomitized limestone consist of fine to medium crystalline sucrosic dolomite, biomicrites, pelmicrites, corals, with well developed crystalline microvuggy porosity. Dolomite has almost obliterated the original structure of the fossils. Very small calcite grains fill fossil cavities. The fine grained (0.1–1 mm) dolomite crystals are brownish and clearer rims. The texture is dominated largely elongation and characteristically have irregular and interlocking boundaries. Stylolitization occurs typically as a haphazard replacement of matrix and sparry calcite by irregular.

Lithification after burial is partly supported by the preferred orientation of microfossil test and other grains (long axes are parallel with bedding) which is result of compaction and deformation.

Geochemistry Two samples from dolomitized limestone were analysed for mineral compositions by XRD. Dolomitized limestone consist mainly dolomite (Fig. 1). 5 samples from limestone and 3 samples from dolomitized limestones were analysed for major and trace element composition by XRF method (Table 1).

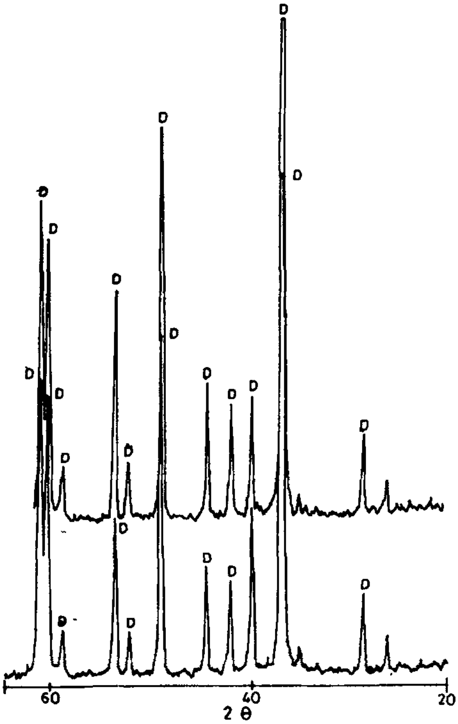

FIG. 1. X-ray diffraction pattern of the dolomitic limestone. D: dolomite

Al_2O_3 shows a positive correlation with Fe_2O_3 and TiO_2 all of which are likely to be contained in clay minerals in different proportions. Where Al_2O_3 is zero or extremely low (Sample 5) clearly the SiO_2 cannot have been introduced into the original sediment in clay mineral and was probably therefore either in traces of detrital quartz or in siliceous organisms.

Fe_2O_3, MgO and Sr remain the same in their respective average concentrations in both limestone and dolomitized limestone. Fe_2O_3 is 0.02–0.26% MgO 052–084% and Sr is 221–487 ppm for limestone, and Fe_2O_3 001%, MgO 22–24.4% and Sr 52–90 ppm for dolomitized limestone. There is a good indication that the Zr was mostly introduced in clay minerals because of the marked correlation of Zr and Al_2O. Pb is 0–14 ppm in all the carbonate rocks. Wedepohl *et al.* (1974) stated that calcite and dolomite can not incorporate appreciable concentrations of Pb, because sea and interstitial waters usually contain very little Pb. Sr is one of the most important minor elements in carbonate rocks especially in dolomites as discussed by Veizer *et al.* (1978) who regarded Sr as an indicator of the derivation of the dolomite. Early diagenetic fine crystalline dolomites

TABLE 1. Major (wt.%) and trace element (ppm) analyses of the rocks

Sa.No	1	2	3	4	5	6	7	8
SiO_2	4.20	4.29	2.52	0.10	1.96	1.07	1.1	0.0
TiO_2	0.05	0.06	0.07	0.04	0.04	0.04	0.02	0.02
Al_2O_3	1.61	1.71	0.32	0.09	0.0	0.14	0.17	0.15
Fe_2O_3	0.13	0.11	0.26	0.02	0.05	0.01	0.00	0.00
MgO	0.71	0.62	0.54	0.52	0.84	22.08	24.38	20.54
Na_2O	0.30	0.30	0.41	0.23	0.75	0.06	0.03	0.00
CaO	54.6	53.64	54.92	54.84	53.74	28.91	33.09	29.33
LOI	39.2	39.7	40.63	42.25	42.83	46.64	42.34	47.67
Total	100.8	100.5	99.7	99.5	100.2	99.00	100.2	97.7
Rb	5	6	5	9	0	5	4	6
Sr	188	246	221	487	339	52	90	73
Zr	26	23	19	bdl	12	16	18	11
Ba	6	bdl	bdl	15	11	28	22	2
Pb	4	3	2	6	4	9	14	0

bdl: below detection limit

have higher Sr contents than later diagenetic dolomites The range of Sr in late diagenetic limestones is typically 90–300 ppm. The chemical composition of chert lenses in the formation have been deposited in a relatively shallow-water environment similar to recent continental shelf slope environments (Kurt, 1994).

Conclusions The studied rocks include coral, Stromatoporoid, crinoid, fusulinid, alg fossils, and shallow water environment chert lenses. The lithological, petrographical and geochemical features of the formation shows that depositional processes governed sedimentation in a reef environment or shallow water environment. Chemical evidence also suggest that strontium is very low in the dolomitized limestone and possibly of late diagenetic origin.

References

Eren, Y. (1993) Ph.D. thesis, Selçuk University, Konya, 224 p (unpublished) (in Turkish).

Kurt, H. (1994) Ph.D. thesis, Glasgow University U.K., 191p (unpublished).

Okay, A.I. (1984) *Türkiye Jeol. Kur., Ketin Simpozyumu, Ankara*, 83–92 (in Turkish).

Özcan, A. Göncüoglu, M.C., Turhan, N., Sentürk, K. and Isik, A., (1988) *METU Journal Pure and Appl. Sci.*, **21**, 211–20.

Veizer,J. Demovic., R. (1974) *J. Sediment. Petrol.*, **44**, 93–115.

Wedepohl, K.H. Correns, C.W., Shav, D.M., Turekian, K.K. and Zemann, J. (1974) *Handbook of geochemistry*, Springer Verlag, Berlin, Heidelberg, New York.