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ENERGIE

1: Prospecting for oil in Africa's continental basins: pioneering explorations and new projects. BITEAU J.-J., BLANPIED CH., ZAUGG P.

Keywords: Hydrocarbons; Oil prospecting; Production; Exploration; Algeria; Angola; Madagascar; Republic of Congo; Africa.

Abstract: Since the end of the Second World War, the parent companies of Total SA have continually engaged in the search for hydrocarbons on the African continent. Following ambitious pioneer phases, successful or unsuccessful, the French petroleum group has adopted new prospecting approaches based on innovative concepts or has exploited new data obtained thanks to technological advances. This article presents four examples drawn from the recent history of its prospecting on the African continent, at different stages of advancement and presenting varied levels of promise.

In: Géosciences; n° 21, Septembre 2016, p. 68-75.

GEOLOGIE STRUCTURALE

2: Fold interference pattern in thick-skinned tectonics; a case study from the external Variscan belt of Eastern Anti-Atlas, Morocco. BAIDDER L., MICHARD A., SOULAIMANI A.

Keywords: Thick-skinned tectonics; Superimposed folding; Inversion tectonics; Croissant-shaped fold; Variscan belt; Anti-Atlas; Ougarta; Morocco; Algeria.

Abstract: Conflicting views are expressed in literature concerning fold interference patterns in thick-skinned tectonic context (e.g. Central Anti-Atlas and Rocky Mountains-Colorado areas). Such patterns are referred to superimposed events with distinct orientation of compression or to the inversion of paleofaults with distinct strike during a singe compressional event. The present work presents a case study where both types of control on fold interference are likely to be combined. The studied folds occur in the Tafilalt-Maider area of eastern Anti-Atlas, i.e. in the E-trending foreland fold belt of the Meseta Variscan Orogen in the area where it connects with the SE-trending, intracontinental Ougarta Variscan belt. Detail mapping documents unusual fold geometries such as sigmoidal and croissant- or boomerang-shaped folds associated with a complex major fault pattern. The folded rock material corresponds to a 6-8 km thick Cambrian-Serpukhovian sedimentary pile that includes alternating competent and incompetent formations. The basement of the Paleozoic succession is made up of rhomboedric tilted blocks that formed during the Cambrian rifting of north-western Gondwana and the Devonian dislocation of the Sahara platform. The latter event is responsible for an array of paleofaults bounding the Maider and South Tafilalt Devonian-Early Carboniferous basins with respect to the adjoining high axes. The Variscan Orogeny began during the Bashkirian-Westphalian with a N-S direction of shortening that converted the NW-trending Ougnat-Ouzina paleogeographic high into a mega dextral shear zone. Folds developed on top of a moving mosaic of basement blocks, being oriented en echelon on the inverted paleofaults or above intensely sheared fault zones. However, a dominantly NE-SW compression responsible for the building of the Ougarta belt also affected the studied area, presumably during the latest Carboniferous-Early Permian. The resulting fold interference pattern and peculiar geometries (J.Tijekht croissant-shaped fold) would exemplify a dual control of deformation by both the variably oriented basement paleofaults and the evolution of the regional shortening direction with time.

In: Journal of African Earth Sciences; vol. 119, 2016, p. 204-225.

3: Remote sensing and field analysis of the Palaeozoic structural style in NW Libya: the Qarqaf arch a paleo-transfer fault zone between the Ghadamis and Murzuq basins. CHOROWICZ J., BENISSA M.

Keywords: Remote sensing; Tectonics; Transfer fault; Variscan belt; Palaeozoic arch; Gargaf; Qarqaf; Ghadamis; Murzuq; Libya; Northern Africa.

Abstract: The N75°E-trending Qarqaf arch in NW Libya separates the Ghadamis and Murzuq basins. We have updated existing geological maps by remote sensing analysis and fieldwork in order to describe the tectonic style of the Palaeozoic units. We have evidenced a Bir Aishah anticline, a Wadi Ash Shabiyat graben and arrays of sedimentary and/or vein quartz dykes that relate to extension fractures or open faults some of them being filled up by on-going sedimentation. We show that continuous brittle syn-depositional deformation occurred throughout the Palaeozoic and progressively with time focused into major faults. The Qarqaf arch is a Palaeozoic right-lateral fault zone comprising main conjugate dextral N60°E and sinistral N90°E fault families. It also comprises ~ N-striking extensional faults with related drag or fault-propagation folds. The Palaeozoic tectonic style is that of rift basins connected by a major transfer fault zone. The arch is as a consequence of strike-slip mechanism. In order to account for distinct folds affecting the Carboniferous strata we argue that partly consolidated silty Devonian and Carboniferous deposits slid in mass by places at the end of their deposition over tilting Devonian layers. Our model is alternative to the currently considered concept of major Variscan compressional orogen in this area. The regional so called 'Variscan' age disconformity actually is the Triassic early Neo-Tethyan event. These general concepts have potential impact on basin modelling of subsidence, uplift, thermal history and hydrocarbon migration. Any new structural geology study in this area is important for oil exploration.

In: Journal of African Earth Sciences; vol. 123, 2016, p. 272-293.

4: Role of tectonic inheritance in the instauration of Tunisian Atlassic fold-and-thrust belt: case of Bouhedma – Boudouaou structures. GHANMI M.A., GHANMI M., ARIDHI S.

Keywords: Tectonic inversion; Rifting; Reactivation; Inheritance; Fault-propagation-fold; Central-Southern Atlas; Boudouaou; Tunisia.

Abstract: Tectonic inversion in the Bouhedma-Boudouaou Mountains was investigated through recent field rock and seismic lines interpretation calibrated with petroleum well data. Located to the Central-Southern Atlas of Tunisia, this area signed shortened intra-continental fold-and-thrust belts. Two dissymmetric anticlines characterize Bouhedma – Boudouaou major fold. These structures show a strong virgation respectively from E-W to NNE-SSW as a response to the interference between both tectonic inversion and tectonic inheritance.

This complex geometry is driven by Mesozoic rifting, which marked an extensional inherited regime. A set of late Triassic –Early Jurassic E-W and NW-SE normal faults dipping respectively to the North and to the East seems to widely affect the overall geodynamic evolution of this domain. They result in major thickness changes across the hanging wall and the footwall blocks in response with the rifting activity.

Tectonic inversion is inferred from convergence between African and European plates since late Cretaceous. During Serravalian – Tortonian event, NW-SE trending paroxysm led to: 1) folding of pre-inversion and syn-inversion strata, 2) reactivation of pre-existing normal faults to reverse ones and 3) orogeny of the main structures with NE-SW and E-W trending.

The compressional feature still remains active during Quaternary event (post-Villafranchian) with N-S trending compression. Contraction during inversion generates folding and internal deformation as well as fault-propagation-fold and folding related strike.

In: Journal of African Earth Sciences; vol. 119, 2016, p. 1-16.

5: Tectonic control on the morphology of the subcircular structure of El Mdaouar (Saharan Atlas, Algeria): insights from geological and remote sensing data. HASSANI M., CHABOU M C., HADDOUM H, HAMOUDI M.

Keywords: Landsat 8 OLI; SRTM; Subcircular structure; El Mdaouar structure; Saharan Atlas; Algeria.

Abstract: El Mdaouar subcircular structure is located in the eastern Saharan Atlas (Algeria) at 35° 05'N and 4° 19' 30'' E, about 20 km southwest of the town of Bou Saada. Its diameter is about 3.2 km and shows a raised rim that stands high above the surrounding terrain. We have carried out a combining remote sensing (Landsat 8 OLI image and Shuttle Radar Topography Mission (SRTM) data) and geological field investigation of the El Mdaouar subcircular structure in order to study its morphology and to determine its origin. In the absence of evidence of magmatism, diapirism, and impact on this structure, a tectonic deformation is the most likely in the origin of this subcircular feature. The counterclockwise rotational motion of the layers explains the morphology of the structure. This rotational motion is probably the result of a combination of the movement of the faults which pass through the structure, in particular two NE-SW strike-slip faults and a NW-SE fault, which marks the eastern limit of the El Mdaouar structure. The NE-SW trending of the structure indicates a NE-SW compressional event, which corresponds to that of the Atlasic phase. This event occurred in the Late Eocene (35 Ma), which is the best estimation of the age of the El Mdaouar structure.

In: Arabian Journal of Geosciences; vol. 9, n° 14, 2016, 632-16 p.

6: The Late Eocene and Late Miocene fronts of the Atlas belt in eastern Maghreb: integration in the geodynamic evolution of the Mediterranean domain. KHOMSI S., FRIZON DE LAMOTTE D., BEDIR M, ECHIHI O.

Keywords: Late Eocene outer front; Late Miocene inner front; Regional cross sections; South Atlas front; Atlas belt; Maghreb; North Africa; Mediterranean domain.

Abstract: Regional cross sections at the scale of the eastern Maghreb based on subsurface and field data allow presenting the structural styles related to the Middle-Late Eocene compressional events. The structural cross sections depict that the Late Eocene front of the Atlas belt extends far through the Northern Africa plate margin comparatively to the Late Miocene front cropping out in the Eastern Tunisian Atlas. The sections allow proposing a new subsurface front for the Atlas belt encompassing a large part of the Pelagian-Sirt basins. The consequences of this particular configuration are discussed at the scale of the south Tethys margin and replaced in the frame of the geodynamic evolution of the Mediterranean domain.

In: Arabian Journal of Geosciences; vol. 9, n° 15, 2016, 650-20 p.

7: Déplacements et contraintes créés par un système de failles. OUYED M.

Mots-clés: Calcul; Faille; Déplacement; Contrainte statique; Réplique; Variation; Fonction de rupture de Coulomb; El Asnam; Zemmouri; Algérie.

Résumé : Cet ouvrage expose l'une des méthodes utilisées pour l'estimation de l'effet de l'interaction des failles. Ce phénomène peut être provoqué par le transfert des contraintes à la suite du glissement sur un plan de faille lors d'un séisme important. Dans le but de réaliser des modèles de la variation de la contrainte statique, nous avons développé un code de calcul qui permet d'obtenir, à partir d'un modèle constitué de plusieurs segments de faille, la variation de la fonction de rupture de Coulomb (Coulomb failure function, CFF) soit sur des failles 'ciblé' selon une direction de glissement donnée, ou sur des plans de faille optimaux en tenant compte du tenseur de contrainte régional. La théorie qui permet l'obtention de ces modèles est exposée et des applications pour tenter de rendre compte de la répartition spatiale des répliques et de leurs solutions focales dans le cas du séisme de Chleff (El Asnam) du 10 octobre 1980 sont effectuées. Un exemple sur l'interaction des failles est illustré à travers le séisme de Zemmouri du 21 mai 2003, pour lequel la variation de CFF est calculée dans le cas des failles 'ciblé' de la Mitidja, du Sahel et de Thénia.

In: Editions Universitaires Européennes. 2010, 160 p.

8: Evidence of fault-propagation folds in foreland basin: the case of Chemsi and Belkhir anticlines of southern Tunisian Atlas. TRIGUI H., AHMADI R., OUALI J., KHALFI CH., MERCIER E.

Keywords: Fault propagation fold; Fault related fold; Kinematics; Hinge migration; Gafsa basin; Tunisian Atlas.

Abstract: Structural analysis of jebel Chemsi and Belkhir located in southern Tunisian Atlas lead to propose the fault-propagation fold a model for these anticlines. Geometric analogy is settled after dip surveys and observation of several anticline kinks. Several, independent geomorphologic observations support the hinge migration kinematics characterizing this numerical model. The geomorphological hallmarks used matches to (1) alluvial fan progradation,

(2) knick points on longitudinal profiles of channel streams and (3) anomalies on the drainage net in the eastern limits of the fold. These anomalies proved a centrifugal hinge migration of, at least, last folding stages in the direction prospected by the model. Results of numerical modelling using Ramp EM software showed detachment layer at 5.5 km that matches to Triassic series. Shortening amplitude is about 2 km for Jebel Chemsi and 1.5 km for Jebel Belkhir. Locally, we highlighted the role of inherited faults in locating and controlling the compressive deformation. In active tectonic region, the use of geomorphological approach is suitable to highlight the folding kinematics and thus to prove the deformation model. In our case study, many special conditions, such as excellent outcropping resulting of arid climate, constant base level and good lithological contrast, allow objective interpretations.

In: Arabian Journal of Geosciences; vol. 9, n° 18, 2016, 706-16 p.

9: Relationship between geo-structural evolution and development of karstic systems in the culminating area of Ouarsenis (West Algeria). ZAAGANE M., REFAS S., KHALDI A., DONZE F., HAMIMED A., SAFA A., MOUSSA K., SEBBANE A., AZZAZ H., MOUASSA S.

Keywords: Structural evolution; Cenozoic; Tectonic events; Karstic systems; Jurassic limestone; Ouarsenis; West Algeria.

Abstract: The Ouarsenis area is one of the most developed karstic systems of Algeria. It is a karst reservoir drinking water with a population of more than 50,000 people taking fully benefit from it. To understand the development of this karstic system, the local tectonic history of the four main mountain ranges of this culminating area (Ouarsenis) has been analyzed. Although previously identified primarily Cenozoic tectonic activities have been observed, a set of NW-SE joints intersecting the Jurassic limestone has been associated to a post-nappes tectonic events. Moreover, numerous joint sets oriented NNE/SSW have been identified almost over the entire culminating area. These joints are the direct consequence of the following stress history: (i) a NW/SE shortening responsible for a major overlap and the first fold (P1) phase, (ii) a second NNE/SSE shortening stage responsible for the second folding (P2) phase associated with 70° N sinistral strike-slip trend, (iii) a WNW/ESE extension phase resulting from the change of σ_3 stress vertical axis, and (iv) a shearing stress creating a 120° N sinistral strike-slip fault. Only the late phases are responsible of the development of joints, which have been karstified later on. Indeed, significant families of karstified joinds, i.e., 20° and 70° N have been found. These joints are related to the extensional and shearing modes, respectively, and linked to a particular in situ karstogenesis. Moreover, this study suggests an ancient establishment of the karstic systems in the Ouarsenis region in at least two stages: pre-figured and activated behaviors during the Cenozoic.

In: Arabian Journal of Geosciences; vol. 9, n° 14, 2016, 638-17 p.

STRATIGRAPHIE

10: Coupling stratigraphic and petroleum system modeling tools in complex tectonic domains: case study in the North Algerian offshore. ARAB M., BELHAI DJ., GRANJEON D., ROURE F., ARBEAUMONT A., RABINEAU M., BRACENE R., LASSAL A., SULZER C., DEVERCHERE J.

Keywords: Stratigraphic and thermal modeling; Tectonic shortening; Facies prediction; Overpressures; Hydrocarbon charge; Algerian margin.

Abstract: In the eastern Algerian offshore basin, 3D basin modeling applied for facies prediction and petroleum potential assessment shows that most favorable zones for reservoir development and hydrocarbon occurrence are located at a maximum distance of 60 km from the coastline. The lack of well data in this area is partly compensated by a large data set of geophysical and geological (G&G) data such as multichannel seismic (MCS), magnetism, wide angle velocity models, and geological outcrops, they represent important constraints for 3D dynamic modeling. Facies distribution model is constrained by sequence and environment evolution through time that is defined from onshore outcrops. 2D structural reconstitution and thermal modeling were also undertaken with ArcTem software. The structural interpretations highlight the occurrence of north-verging ramps during the Quaternary which played an important role in HC generation and migration. Three source rocks have been considered for maturatin modeling with Temis Flow software, Burdigalian , Langhian, and Tortonian. They are found to be in gas window in the deep areas and locally in oil

window at shallower structured zones. The modeling results indicate that the main fluid discharge was focused toward the southern border of the offshore basin where recent thrust faults (parallel to the margin) are located. In order to test the role of these faults in terms of hydrocarbon migration and trapping, two scenarios are considered according to whether they were sealed or not. In both cases, the 2D/3D simulations depict overpressures (2,000-4, 000 psi) in the pre-salt sedimentary package. However, the hydrocarbon charge is most efficient with the sealing faults for the lower Langhian and lower Messinian reservoirs. The hydrocarbon potential depends mostly on the lateral extension of seals, their sealing capacity and the organic carbon (TOC) content of potential source rocks. Besides, the sea drop of about 1,000 m during the Messinian salinity crisis has induced depressurization that caused oil and gas seepage from Miocene reservoirs.

In: Arabian Journal of Geosciences; vol. 9, n° 4, 2016, 289-32 p.

11: Reconstruction of the Late Cretaceous-Paleocene paleoenvironment (northern Tunisia) from biostratigraphy, geochemistry and clay mineralogy. BEN M'BAREK JEMAÏ M., KARAOUI YAAKOUB N., SDIRI A., AZOUZI R., CHERNI R., BEN AISSA L., DUPLAY J.

Keywords: Paleoenvironment; Clay mineralogy; Geochemistry; Biostratigraphy; Northern Tunisia.

Abstract: A multidisciplinary approach was adopted for the reconstitution of the depositional environments based on clay minerals distribution, biostratigraphy and geochemical properties of the Late Cretaceous-Paleocene deposits. Evolution of the mineralogical compositions (i.e. clay minerals contents) was ascertained in two cross sections from the Late Cretaceous and Paleocene belonging to different paleogeographic domains: the Bir M'Cherga (Tunisian Dorsal) and Tajerouine (Northern West of Tunisia) study sites. Chemical analysis of the original clay samples, collected in both sites (i.e. Late Cretaceous and Paleocene clays), showed significant amounts of oxides including calcium, silica, alumina and iron. Three distinct mineralogical zones were identified. Clay mineral assemblages of the Late Cretaceous showed the predominance of kaolinite, subordinated by variable proportions of illite and smectite. In contrast, those of Paleocene clearly showed the predominance of smectite to the detriment of kaolinite and illite. The predominance of kaolinite in the Late Creatceous clay deposits indicated a calm and shallow depositional environment influenced by hot and wet climate, especially in northeastern Tunisia (Bir M'Cherga study site). Kaolinite typically forms under lacustrine environment where appreciable movement of water would be expected, leading to the development of kaolinite. During Paleocene, the smectite enriched mineralogical sequence suggested similar climatic conditions with further deepening of the depositional environment in salt lakes. The regional geodynamic context of both sections showed an important Maastrichtian unconformity with a Paleocene major hiatus extending from the East to the West.

In: Arabian Journal of Geosciences; vol. 9, n° 2, 2016, 138-12 p.

12: Basin geodynamics and sequence stratigraphy of Upper Triassic to Lower Jurassic deposits of Southern Tunisia. CARPENTIER C., HADOUTH S., BOUAZIZ S., LATHUILIERE B., RUBINO J.-L.

Keywords: Late Triassic; Early Jurassic; Sequence stratigraphy; Basin geodynamics; Tunisia.

Abstract: Aims of this paper are to propose a geodynamic and sequential framework for the late Triassic and early Jurassic of and south Tunisia and to evidence the impact of local tectonics on the stratigraphic architecture. Facies of the Upper Triassic to Lower Jurassic of Southern Tunisia have been interpreted in terms of depositional environments. A sequential framework and correlation schemes are proposed for outcrops and subsurface transects. Nineteen middle frequency sequences inserted in three and a half low frequency transgression/regression cycles were evidenced. Despite some datation uncertainties and the unknown durations of Lower Jurassic cycles, middle frequency sequences appear to be controlled by eustasy. In contrast the tectonics acted as an important control on low frequency cycles. The Carnian flooding was certainly favored by the last stages of a rifting episode which started during the Permian. The regression accompanied by the formation of stacked angular unconformities and the deposition of lowstand deposits during the late Carnian and Norian occurred during the uplift and tilting of the northern basin margins.The transpressional activity of the Jeffara fault system generated the uplift of the Tebaga of Medenine high from the late Carnian and led to the Rhaetian regional angular Sidi Stout unconformity. Facies analysis and well-log correlations permitted to evidence that Rhaetian to Lower Jurassic Messaoudi dolomites correspond to brecciated dolomites present on the Sidi Stout unconformity in the North Dahar area. The Early-cimmerian compressional event is a possible origin for the global uplift of the northern African margin and Western Europe during the late Carnian and the Norian.

During the Rhaetian and the early Jurassic a new episode of normal faulting occurred during the third low frequency flooding.

This tectonosedimentary evolution ranges within the general geodynamic framework of the north Gondwana margin controlled by the opening of both Neotethys and Atlantic oceans.

In: Journal of African Earth Sciences; vol. 117, 2016, p. 358-388.

13: A Miocene-restricted platform of the Zibane zone (Saharan Atlas, Algeria), depositional sequences and paleogeographic reconstruction. CHEBBAH M.

Keywords: Miocene; Depositional environment; Paleogeography; Atlasic domain; Zibane zone; Algeria.

Abstract: Depositional sequences and paleogeographic evolution of the Miocene deposits have been studied in the Zibane zone (Saharan Atlas, Algeria) located at the north of the African platform. During the Miocene, this region corresponded to a fault-bounded collapse area and filled by diversified deposits, showing important lateral facies and thicknesses variations. The studied deposits are divided into five depositional sequences separated by major unconformities. These depositional sequences are well developed in the whole basin and testify a paleogeographic differentiation from E-W, induced by a set of NW-SE-trending old faults inherited from the Atlasic orogeny. The organization and the development of those sequences make it possible to correlate them better to the basin scale, which is integrated in a model of restricted platform intersected by NW-SE faults where the tectonic-sedimentation duality is predominant. These new data point to a paleogeographic evolution different from the one usually admitted environment for this region during Miocene time and plead in favour of a reconsideration of the depositional environments of the post-Burdigalian formations in the Zibane zone of the Algerian Atlasic domain.

In: Arabian Journal of Geosciences; vol. 9, n° 2, 2016, 151-14 p.

14: Evidences of "Lago-Mare" episode around the Messinian-Pliocene boundary in eastern Tunisia (Central Mediterranean). FRIGUI M., BEN YOUSSEF M., OUAJA M.

Keywords: Messinian; Pliocene; Brackish fauna; Lago-Mare; Eastern Tunisia; Mediterranean.

Abstract: Eight stratigraphic sections, located in northeastern part of the Sahel area of Tunisia recorded evidences of 'Lago-Mare' episode and events related to the Messinian-Late Pliocene interval. A comparison with previous studies carried on sections from neighboring areas and boreholes data drilled within the Gulf of Hammamet and the Gulf of Gabès, is conducted and gives useful information to characterize the Late Messinian to Late Pliocene events. The most notable feature distinguished in the studied area consists on the lack of gypsum, commonly recorded in relation with the crucial event of the Messinian salinity crisis. However, only lagoonal deposits, bearing messinian brackish fauna, are encountered. These sediments are usually attributed to the "Segui" formation or the so called "Mio-Pliocene continental". Thin sections samples and field observations have recognized sands, marls, clays, lacustrine limestone, some gypsum lenses, mud-cracks, lignite and Messinian brackish fauna. Similar deposits were previously described in the Kechabta basin from the Northern Tunisia and in some wells from the Gulf of Gabès and the Gulf of Hammamet. We suggest that all these facies belong to the coeval of the "Lago-Mare" facies within Eastern and Western Mediterranean basins (e.g. Sicily, Mallorca, Libya and Cyprus). Finally, four major erosional surfaces have been recorded within the Late Messinian-Late Pliocene deposits, aged post-Tortonian, intra-Messinian, Late Messinian and intra-Pliocene times. They seem to be the result of local tectonic uplifts and eustatic fluctuations.

In: Journal of African Earth Sciences; vol. 123, 2016, p. 57-74.

15: Le Cénomano-Turonien dans la Hamada du Tinrhert (Sahara, Algérie) : résultats préliminaires. ZAOUI DJ., TCHENAR S., BENYOUCEF M., MEISTER CH., ADACI M., PIUZ A., MEBARKI K., BENSALAH M., GABANI A., MAHBOUBI M.

Mots-clés : Cénomano-Turonien; Biostratigraphie; Paléoenvironnement; Tinrhert; Sahara; Algérie.

Résumé : Le présent travail vise à donner une description litho-, biostratigraphique, une analyse sédimentologique et une interprétation paléoenvironnementale du Cénomano-Turonien de la partie orientale du Tinrhert (sud-est algérien). Cinq coupes stratigraphiques ont été levées et échantillonnées. Sur la base des caractéristiques lithologiques et paléontologiques, les dépôts analysés ont été divisés en trois formations à unités lithostratigraphiques informelles : (1) la formation des calcaires inférieurs comprend quatre unités : (a) les calcaires pré-Neolobites, (b) les calcaires à Neolobites, (c) les calcaires à Vascoceras et (d) les marno-calcaires à Choffaticeras . (2) la formation des marnes médianes est très homogènes dans la partie orientale de la Hamada du Tinrhert et se distingue dans la partie occidentale (secteur de Bordj Omar Driss) par l'individualisation de deux unités à caractères lithologiques distincts : (a) une unité silicoclastique et (b) une autre carbonatée ; (3) la formation des calcaires supérieurs correspond à une barre carbonatée d'épaisseur métrique très continue dans l'aire étudiée. Le découpage biostratigraphique est basé sur l'analyse de nouvelles récoltes d'ammonites qui correspondent à une période couvrant le Cénomanien supérieur (zone à Calycoceras guerangeri) et le Turonien inférieur (zone à Watinoceras coloradoense), soit environ 3 millions d'années. A défaut de marqueurs paléontologiques précis, la limite C-T reste difficile à cerner. L'étude sédimentologique à partir de l'analyse des faciès permet de définir les mécanismes et l'organisation des dépôts. Quinze faciès sédimentaires (FT1 à FT15) ont été reconnus et regroupés en cinq assemblages de faciès appartenant à des environnements de dépôt allant de la rampe proximale à la rampe distale, voir jusqu'au bassin.

In : Revue de Paléobiologie (Genève) ; vol. 35, n° 2, 2016, p. 541-559.

SEDIMENTOLOGIE

16: Tectono-sedimentary evolution of the Miocene Oued Dayr formation (Ghomaride Complex, Internal domain of the Maghrebian Rif belt, Morocco). EL OUARAGLI B., ZAGHLOUL M.N., EL TALIBI H., SOMMA R.

Keywords: Sedimentological; Petrographic; Structural analysis; Middle-late? Miocene; Internal units; Rif belt; Oued Dayr; Morocco.

Abstract: This work deals with sedimentological, petrographic, and structural analyses of a middle Miocene late-orogenic sedimentary cycle, denoted Oued Dayr formation, recognized in the Rifian sector of the Maghrebian Chain (Morocco). The analyzed formation (75 m thick) starts with 15-20 m of light colored polymict conglomerates, with minor sandstone beds, lying on the Paleozoic basement and Mesozoic cover of the Ghomaride nappe. Facies analysis indicates a fining-upward deposition in a marine environment characterized by increasing deepening, reflecting a subsidence rate that exceeds sedimentary supply. Petrographic analysis points out that sandstones are represented by litharenites originated by erosion of recycled orogen. The conglomerates pebbles and cobbles consist of Alpine low- to high-grade metamorphic rocks as metarenites, phyllites, mylonitic quartzites, micaschists, augen gneisses deriving from the exhumed deep metamorphic basement, the overlying metasedimentary of the Sebtide Nappes and of sedimentary rocks as sandstones, jaspes, limestones, and shales deriving from the Ghomaride Nappes and their sedimentary cover. Data reveal mixed provenance indicating that the Oued Dayr formation was fed by the internal Nappes stack of the Maghrebian chain. Structural analysis shows that the Oued Dayr formation accumulated in a thrust-top basin, during an early extension (D_0 phase), recorded by synsedimentary normal faults within middle Langhian deposits on the rear of the Internal Nappes stack. Subsequent ductile and brittle compressional (D_1, D_2, D_3) and extensional (D_4) deformation phases occurred during and/or after the stacking, exhumation, and early unroofing of Sebtide Complex coeval with the opening of the Western Mediterranean back-arc basins since middle Miocene time.

In: Arabian Journal of Geosciences; vol. 9, n° 15, 2016, 660-28 p.

17: Characterization of sandstone units as proven reservoirs in the Upper Jurassic M'Rabtine formation, SE Gulf of Gabes, Tunisia. HAMMAMI K., ZAGRANI M.F., NASR I.H., GHUEDIFI H., BEN SALEM A., BOUGDIRI M.

Keywords: Kimmeridgian-Tithonian; Petrophysical analysis; Reservoir; M'Rabtine formation; Gulf of Gabes; Tunisia.

Abstract: Upper Jurassic studies, based on well correlation, stratigraphy, and well-logging analysis, allow us to define six sedimentary units of M'Rabtine formation in the Gulf of Gabes. Unconformities characterized by the absence of the

evaporitic member (MEVP), unit of M'Rabtine formation (Kimmeridgian-Tithonian), in the most western part and the gap of the M'Rabtine formation in the most eastern part of the study area give us an idea of the paleogeography and the variation of deposit environment. Petrophysical evaluation and lithological determination from well-logging data show that sedimentary unconformities and facies lateral variation are related to salt tectonic and/or probably eustatic events. Reservoir parameters show grained sandstone units defined as potential reservoirs and producing hydrocarbon in P6 and P8. M3 and M5 units in P6 are a good oil reservoir with a porosity average between 17.5 and 25%. In P8, M3, M4, and M5 correspond to the aim reservoir with a porosity average between 24 and 29 %.

In: Arabian Journal of Geosciences; vol. 9, n° 2, 2016, 139-12 p.

18: Rainfall irregularity and its impact on the sediment yield in Wadi Sebdou watershed, Algeria. MEGNOUNIF A., NEKKACHE GHENIM A.

Keywords: Sediment load; Sediment rating curve; Semiarid; Water discharge; Wadi Sebdou; Algeria.

Abstract: The impact of changes in rainfall can be studied by means of the sediment transport in the rivers. The link between rainfall irregularity and sediment rating parameters was investigated in the Wadi Sebdou watershed of 256 km^2 located in northwest Algeria. The data set includes rainfall records and cover the period from September 1939 to August 2009. Hydrometric records consist of instantaneous measurements flow discharge, Q, and suspended sediment concentration, C, based on a monitoring program from September 1973 to August 2003. In neighboring gauging stations, the periods of record were either short or discontinuous and may not be representative to assess the potential causes of suspended-sediment changes. The time evolution of sediment rating parameters was used to improve understanding of interaction between sediment delivery supplied from internal and external sources to the wadi channel. Our findings indicate that the rating parameters varied by many orders of magnitude, suggesting significant temporal change in both potential of sediment yield and sediment sources. High b-parameter (1.12) and low a-parameter values (0.018) were observed during the time interval of change from wet to dry period occurred in the mid of 1970s. The growth of vegetation and the well-developed organic soil horizons have reduced runoff and prevented particle detachment and transport. So, the functioning of sediment sources external to the channel was comparable to that of temperate regions. After that transition, the prolonged dryness has led to a higher risk of desertification and critical soil erosion. Therefore, the functioning of sediment sources external to the wadi-flow becomes similar to that observed in arid river systems, while the fluctuation of sediment contribution supplied from hydrographic network suggests a watershed functioning as semi-arid streams. The watershed ability to sediment yield was high toward the mid of the dry period and sediment delivery supplied from sources both internal and external to the wadi channel was copious suggesting a large amount of stored sediment at the beginning of a runoff season and an increased transport capacity of the river.

In: Arabian Journal of Geosciences; vol. 9, n° 4, 2016, 267-15 p.

GEOLOGIE REGIONALE-CARTES

19: Cartographie géologique des fonds marins côtiers. Exemples le long du littoral français. AUGRIS C., CLABAUT PH.

Mots-clés: Géologie; Fonds marins côtiers; Cartographie; Sonar à balayage latéral; Sédiments; France.

Résumé : Ce document présente la nature géologique, les caractéristiques morphologiques et dynamiques, de différents secteurs des fonds marins côtiers français (métropole et départements d'outre-mer) cartographiés par l'Ifremer au cours de cette dernière décennie. Bancs sableux du Nord-Pas de Calais, reliefs rocheux du Pays Basque, récifs coralliens aux Antilles, ces fonds sont variés et convoités, comme en témoignent les diverses traces d'activités. La continuité entre le domaine marin et le littoral, ainsi que des exemples d'application de cette cartographie sont également abordés.

In: Ed. Ifremer; 2001, 75 p.

20: Cartographie de l'alea géologique à partir des images Alsat-2 de la région de Bejaïa. BENNIA A., SAADI AE., MESBAH CH., FARADJI Y., MOKADEM S.,

Mots-clés: Lithologie; Multi-spectral; Satellite; Structurale; Béjaïa; Algérie.

Résumé : L'étude du glissement de terrain dans la région de Béjaïa a été effectuée dans le but de cartographier les zones soumises au risque de glissement de terrain par typologie d'aléa géologique (glissement, éboulement, effondrement et autres), en se basant sur l'utilisation des données images Alsat-2 combinées aux systèmes d'information géographique. Ce travail s'inscrit dans le cadre d'un projet de coopération entre l'Agence Spatiale Algérienne et l'Agence du Service Géologique d'Algérie (ASGA). L'objectif principal de l'étude est l'identification des zones à risque et leur hiérarchisation en fonction des zones à risque et leur hiérarchisation en fonction du degré de risque potentiel ainsi que la définition du contexte structural et son rôle dans le fonctionnement du glissement de terrain.

Les images ainsi utilisées ont permis d'avoir des informations probantes sur la structure et sur la lithologie de la région; qui sont des facteurs essentiels d'évaluation spatiale du risque de glissement de terrain. Ce phénomène exige une cartographie systématique des facteurs de contrôle qui influent sur l'instabilité des versants ainsi que l'inventaire des glissements existants.

L'intégration des données obtenues après interprétation des images Alsat-2 (lithologie, structures, fracturation) dans un modèle probabiliste en combinaison avec d'autres données (pente, exposition des versants et réseau hydrographique) ont permis de délimiter les zones à risque et d'établir une carte finale de risque d'aléa géologique (carte des zones susceptibles au glissement de terrain).

Cette carte peut être utilisée non seulement pour la prévention des risques de glissement mais aussi pour la gestion des ressources naturelles dans la région.

In: Actes de l'Atelier National « ALSAT-utilisateurs » 05-06Avril 2017, p. 205-211.

21: Cartographie thématique Traité IGAT, série aspects fondamentaux de l'analyse spatiale. CAUVIN C., ESCOBAR F., SERRADJ A.

Mots-clés: Atlas; Cartographie ; Généralités; Satellites; Télédétection; Carte; Transformation.

Résumé: Cet ouvrage, en 5 volumes, porte sur la cartographie thématique. La carte y est considérée comme une construction issue de processus de transformations, comprenant des étapes successives, placées dans un ordre strict, intégrées dans un raisonnement logique et impliquant des choix.

Les deux premiers volumes regroupent les transformations indispensables pour la production de toute carte thématique, appuyée sur la démarche scientifique. Quatre étapes y sont approfondies: le passage des entités géographiques aux objets cartographiques, la transformation des [XY], les transformations cartographiques [XYZ], la transformation sémiotique.

Le second volume s'achève sur les aspects techniques donnant les clefs de lecture de la carte.

Le troisième volume porte sur l'apport des méthodes quantitatives aux transformations des attributs [Z], en accordant une place spécifique à la discrétisation d'une seule variable. Pour le traitement de plusieurs variables, il regroupe de nombreux procédés graphiques et mathématiques de généralisation et de modélisation thématique et spatio-thématique.

Le quatrième volume concerne des méthodes existant depuis de nombreuses années mais renouvelées par l'apparition de l'ordinateur tant au niveau des transformations cartographiques (anamorphoses) que des transformations d'affichage représentations 2.5 D et 3 D.

Enfin le cinquième volume met l'accent sur les conséquences des trois révolutions qui ont touché la cartographie depuis la fin des années cinquante: révolution numérique, du multimédia et de l'internet et du web.

Les technologies actuelles (animation, interactivité, multimédia, etc.) renouvellement ainsi fondamentalement la discipline ouvrant sur la géovisualisation, proposant des solutions pour la cartographie de données spatio-temporelles et permettant le développement de nouveaux métiers pour la cartographie.

In: Ed. Lavoisier – Ed. Hermes-science; 2007, 5 volumes.

22: PCA and SVM as geo-computational methods for geological mapping in the southern of Tunisia, using ASTER remote sensing data set. GASMI A., GOMEZ C., ZOUARI H., MASSE A., DUCROT D.

Keywords: PCA; SVM; ASTER; Geological mapping; Tunisia.

Abstract: The purpose of this study was to examine the efficiency of Advanced Space Borne Thermal Emission and Reflection Radiometer (ASTER) data in the discrimination of geological formations and the generation of geological map in the northern margin of the Tunisian desert. The nine ASTER bands covering the visible (VIS), near-infrared (NIR) and short-wave infrared (SWIR) spectral regions (wavelength range of 400-2500 nm) have been treated and analyzed. As a first step of data processing, crosstalk correction, resampling, orthorectification, atmospheric correction, and radiometric normalization have been applied to the ASTER radiance data. Then, to decrease the redundancy information in highly correlated bands, the principal component analysis (PCA) has been applied on the nine ASTER bands. The results of PCA allow the validation and the rectification of the lithological boundaries already published on the geologic map, and gives a new information for identifying new lithological units corresponding to superficial formations previously undiscovered. The application of a supervised classification on the principal components image using a support vector machine (SVM) algorithm shows good correlation with the reference geologic map. The overall classification accuracy is 73 % and the kappa coefficient equals to 0.71. The processing of ASTER remote sensing data set by PCA and SVM can be employed as an effective tool for geological mapping in arid regions.

In: Arabian Journal of Geosciences; vol. 9, n° 20, 2016, 753-12 p.

23: La grande Kabylie dans le contexte algérien vue par les géosciences. SAADALLAH A.

Mots-clés: Géoscience; Géologie; Evolution géodynamique; Pétrologie; Tectonique; Nappe cristalline; Tectonique des plaques; Grandes Kabylie; Algérie.

Résumé : Ce livre, « aboutissement d'une passion », s'adresse aux géoscientifiques qu'ils soient étudiants, professionnels, chercheurs, enseignants universitaires et de lycées. Il pourrait aussi attirer les amoureux de la géologie, des roches et paysages idylliques géologiques que l'Algérie offre, comme un musée à ciel ouvert, à tous ceux qui aiment la contemplation. Il présente en 11 chapitres la Grande Kabylie telle que l'auteur la voit sous l'angle des géosciences, en puisant dans ses travaux de terrain et de laboratoire menés avec son équipe de thésards, en décortiquant les publications spécialisées, pendant des décennies. La géologie de l'Algérie occupe une part importante (80 pages), car le contexte est nécessaire pour saisir l'évolution géodynamique. Les nappes cristallines sont exposées et illustrées par des figures, photos et cartes détaillées, de la plus profonde de la pile tectonométamorphique, i.e. la nappe des paragneiss, la nappe de type crocodile de Sidi Ali Bou Nab, la nappe des micaschistes à la nappe sommitale des schistes, avec leurs semelles d'orthogneiss. Les aspects pétrométamorphiques ainsi que les traits métamorphiques et structuraux sont analysés systématiquement pour en dégager les constructions synmétamorphes ductiles précoces oblitérées par la fracturation tardive peu profonde, le tout au cours du processus d'exhumation des MCC (Metamorphic Core Complexes). Une sysnthèse finale aboutit au modèle théorique de la chaîne des Maghrébides que l'auteur expose avec plus d'arguments par rapport à ses publications antérieures. La méthodologie de travail sur le terrain traverse de part en part cet ouvrage dans le but de permettre aux étudiants et chercheurs d'en saisir l'essentiel tout en avertissant du piège dogmatique à éviter pour se construire une expérience professionnelle et scientifique basée sur un va et vient, incessant, vital entre la pratique et la théorie, se nourrissant et s'enrichissant mutuellement en synergie. Toujours animé par le souci didactique, l'auteur accompagne le texte du début à la fin par plusieurs centaines d'encadrés, courtes explications, éclairant les notions scientifiques et techniques mentionnées, plus particulièrement des cristallins, la géologie structurale et finalement la tectonique des plaques.

In: Ed. INGESE; 2016, 236 p.

PALEONTOLOGIE

24: La contribution de Pierre François Marie Bourdet (1785-1824), dit le Chevalier Boudet de la Nièvre, à la paléontologie. BRIGNON A.

Mots-clés: Histoire de la paléontologie; George Cuvier ; Elaslobranchii; Actinopterygii; Chelonii; Aptychus; Fraude scientifique.

Résumé : Ancien militaire français dans l'armée impériale, Pierre François Marie Bourdet se consacre à l'étude des fossiles entre 1820 et 1824 alors qu'il résidait à Genève. Ses travaux dans le domaine de la paléontologie n'étaient connus jusqu'alors que par quelques allusions faites par Cuvier dans ses recherches sur les ossements fossiles et par de courtes notices publiées dans des comptes rendus de séances de sociétés savantes de l'époque. Deux mémoires manuscrits de Bourdet conservés à la bibliothèque de Genève et à la Bibliothèque centrale du Muséum National d'Histoire Naturelle (Paris) permettent de faire la lumière sur son travail à une époque cruciale dans le développement de l'anatomie comparée et de la paléontologie. Ces travaux inédits sont intitulés « Histoire naturelle des ichthyodontes, ou dents de poissons fossiles » et « Mémoire sur différentes espèces de tortues fossiles ». La correspondance de Bourdet avec Alexandre Brongniart, Georges Cuvier, Henri-Marie Ducrotay de Blainville, Bernhard Studer et le prince Christian Frederik de Danemark permet de préciser le contexte historique de ces deux études. Les dessins accompagnant ces travaux inédits révèlent des fossiles qui étaient conservés dans les collections de la famille Deluc, Karl August Friedrich Meisner, Jakob Samuel Wyttenbach, Charles-Aloyse Fontaine et celle du prince Christian Frederik de Danemark. Plusieurs de ces spécimens historiques, découverts pour la plupart il ya plus de deux cents ans, ont pu ainsi être retrouvés au Muséum d'histoire naturelle de la ville de Genève et au Naturhistorisches Museum der Burgergemeinde Bern. Bourdet est le premier à avoir utilisé la nomenclature binominale pour les chéloniens fossiles. Il est également un des premiers à avoir eu l'idée de publier une étude entièrement consacrée aux dents de « poissons » fossiles (Chondrichthyes et Actinopterygii), dix ans avant les travaux de Louis Agassiz. L'analyse détaillée des figures données par Bourdet révèle cependant des palgiats, des falsifications et des fabrications de données. Sa soif de reconnaissance par ses pairs et son empressement à être élu membre des plus prestigieuses sociétés savantes semblent avoir été les motivations principales qui poussèrent Bourdet à falsifier une partie de ses travaux pour les rendre plus attractifs. Cette étude dévoile ainsi un des premiers cas de fraude scientifique dans le domaine de la paléontologie.

In: Revue de Paléobiologie (Genève); vol. 35, n° 1, 2016, p. 1-110.

25 : L'ammonitico-rosso toarcien de l'Oued Zraa (bordure NW du Moyen-Atlas plissé, Maroc): études biostratigraphiques, sédimentologiques et cadre paléogéographique. EL HAMMICHI F., BENSHILI KH., EL ARABI H., TABYAOUI H., CHARRIERE A.

Mots-clés: Ammonitico-rosso; Toarcien; Biostratigraphie; Découpage tectono-sédimentaire; Paléogéographie; Oued Zraa; Moyen Atlas; Maroc; Algérie.

Résumé : Situé à l'articulation du sillon moyen atlasique et de la plate-forme nord-occidentale, l'ammonitico-rosso toarcien de l'Oued Zraa fait ici l'objet d'analyses sédimentologiques et d'études biostratigraphiques détaillées. Quatre coupes réparties sur deux sites permettent de préciser la bio-chronologie des différents niveaux de l'ammonitico-rosso et de son substratum.

Aux formations dolomitiques massives du Lias inférieur succèdent des dolomies litées, remplacées latéralement par des calcaires lités bioclastiques qui ont livré des ammonites du Domérien (Pliensbachien supérieur). Le passage à l'ammonitico-rosso toarcien est brutal et souligné par une importante discontinuité sédimentaire associée à une lacune du Pliensbachien terminal. La série se poursuit par deux faisceaux d'ammonitico-rosso calcaires datés du Toarcien inférieur à moyen, qui évoluent verticalement vers un ammonitico-rosso marneux du Toarcien moyen, plus développé vers l'est. Le tout est coiffé par des calcaires délités en plaquettes à laminites bioclastiques et riches en bioclastes « calcaires à filaments ». Les peuplements d'ammonites sont abondants et très déséquilibrés, dominés par les platycônes (Hildoceras). Ils sont représentés surtout par des ammonites de petite taille (4 à 5 cm) généralement mal conservées: écrasées, usées, fragmentaires et déformées. Elles datent les divers horizons (Sublevisoni, Lusitanicum, Bifrons et Semipolitum) de la zone à Bifrons (Toarcien moyen). La zone basale du Toarcien (Polymorphum) est bien établie, alors qu'il est plus difficile de distinguer la zone à Levisoni. A cette incertitude près, on peut envisager la persistance de l'ammonitico-rosso durant le Toarcien inférieur et le Toarcien moyen.

L'état très bioturbé, usé et fragmentaire des ammonites ainsi que leur petite taille témoignent d'un milieu de dépôt instable associé à l'isolement des peuplements d'ammonoîdes. Cet isolement est lié au comartimentage tectono-sédimentaire original de la bordure NW du sillon moyen atlasique au niveau de l'Oued Zraa avec une double structuration, d'une part directionnelle (N40°E) et d'autre part transverse (N100-120°E).

La présence d'autres dépôts de type ammonitico-ross le long de l'accident nord moyen atlasique traduit la persistance au Toarcien de cette ligne paléogéographique et paléostructurale ayant séparé le bassin subsident au SE de la plate-forme stable au NW. Ces dépôts se différencient des séries gréso-ferrugineuses rubéfiées jalonnant les bordures méridionales des sillons atlasiques. L'ammontico-rosso calcaréo-marneux de l'Oued Zraa se rattache aux cortèges des faciès noduleux et des ammonitico-rosso véritables bien développés dans l'avant-pays rifain du NE marocain et dans l'Ouest algérien.

In: Revue de Paléobiologie (Genève) ; vol. 35, n° 2, 2016, p. 517-540.

26: Middle-to-Late Pleistocene malacofauna from the archeopaleontological site of Oued Sarrat (Tajerouine area, NW Tunisia). KAROUI-YAAKOUB N., MTIMET M.S., BEJAOUI S., AMRI L., KHALLOUFI N., BEN AISSA L., MARTINEZ-NAVARRO B.

Keywords: Malacofauna; Middle-Late Pleistocene; Paleoenvironment; Acheulian; Oued Sarrat; NW Tunisia.

Abstract: The malacofauna collected from the archeopaleontological site in Oued Sarrat (Tajerouine area, NW Tunisia) is the first reference from the Middle and Late Pleistocene stratigraphic series in Tunisia. These malacologic assemblages are abundant but little diversified; they are considered as continental, lakeside, and fluviatile ecosystem forms. They are associated with bones of small and large vertebrates and lithic artifacts. The dominant species of gastropods are Cernuella virgata (Da Costa, 1778), Xerosecta cespitum (Draparnaud, 1801), and Sphincterochila baetica (Rossmässler, 1854) which are typical of the Mediterranean regions. The abundance of these pulmonate terrestrial gastropods indicates a post-mortem transport of shells by floods and fluvial channels. The only bivalve, Unio ravoisieri (Deshayes, 1847), still common in the rivers of northern Tunisia, characterizes a typical lakeside environment, with relatively low energy. Considering the recently discovered associated vertebrate remains, their occurrence corroborates the onset of a paleoenvironment landscape with swamps, or even a shallow freshwater paleolake with close forests. Hence, this environment also inhabited by a diversity of large mammal species and other abundant microvertebrates and invertebrates was a support for human survival within these northern African latitudes.

In: Arabian Journal of Geosciences; vol. 9, n° 5, 2016, 345 – 9 p.

27: On the last occurrence of Marginella Lamarck, 1799 (gastropoda, Marginellidae) in the Mediterranean: description of a new species from the Early Pleistocene and paleoceanographic implications. LA PERNA R., VAZZANA A.

Keywords: Marginella; Shape analysis; Early Pleistocene; Messina strait; Paleoceanography; New species: Mediterranean.

Abstract: A new species of Marginella Lamarck, 1799 is described from the Early Pleistocene of the Messina Strait area, M. seguenzai n.sp. The remarkable variability in shell size and shape required a preliminary morphometric analysis, which provided evidence of a single species. This is the last known representative of the genus Marginella in the Mediterranean, today highly diverse in the tropical and subtropical shallow waters of West Africa, up to about 28°N. The genus Marginella was thought to have disappeared from the Mediterranean and the adjacent Atlantic after the Early Pliocene, due to early cooling phases. Anyway, Marginella seguenzai n.sp. was a deep water species, and its extinction was most probably due to the loss of psychrosphere, in the Early Pleistocene, rather than to climatic deterioration. The remarkable closeness between the new species and a deep water living species, endemic to three seamounts in the NE Atlantic, suggests a common origin for both species. High productivity seems to have been a key factor in the Mediterranean distribution of Marginella, either in shallow and deep waters.

In: Geodiversitas; vol. 38, n° 3, 2016, p. 451-461.

28: Biozones de calpionelles et d'ammonites du Berriasien inférieur et moyen de la formation Sidi Kralif au Jebel Meloussi, Tunisie centrale. MAALAOUI K., ZARGOUNI F.

Mots-clés: Berriasien; Ammonites; Calpionelles; Formation Sidi Kralif; Jebel Meloussi ; Tunisie centrale.

Résumé : L'étude détaillée de la coupe de Sidi Kralif au Jebel Meloussi a permis d'identifier les principales zones et sous-zones de calpionelles et des ammonites du Berriasien inférieur et Berriasien moyen. Ainsi, les sous-zones B2, B3, C1 et C2 de calpionelles, la sous-zone à Grandis et la zone à Occitanica des ammonites ont été bien caractérisées. Les associations des biozones de calpionelles de la coupe étudiée ont été comparées aux associations signalées dans d'autres régions du globe, en particulier le Sud-Est de la France et le Rif externe (Maroc).

In: Revue de Paléobiologie (Genève); vol. 35, n° 1, 2016, p. 373-384.

29: Ostracodes cénomano-turoniens dans l'Atlas saharien occidental et le bassin du Guir (sud-ouest de l'Algérie): systématique, biostratigraphie et paléobiogéographie. MEBARKI K., SAUVAGNAT J., BENYOUCEF M., ZAOUI DJ., BENACHOUR H.B., ADACI M., MAHBOUBI M., BENSALAH M.

Mots-clés: Ostracodes; Systématique; Biostratigraphie; Paléobiogéographie; Cénomanien; Turonien; Atlas saharien occidental; Bassin de Guir; Algérie.

Résumé : Trois coupes, l'une dans l'Atlas saharien occidental (Djebel Rhoundjaia dans les Monts des Ksour) et deux dans le bassin du Guir (au sud près de Kénadsa, région de Béchar; au nord, Chebket Berridel, près de Boukais) ont livré 19 espèces d'ostracodes: 2 espèces cosmopolites, Cytherella gr. ovata et Cytherella parallela, connues habituellement comme étant nord-téthysiennes; 12 espèces connues sur tout ou partie de la marge sud-téthysienne; 3 espèces proches d'espèces sud-téthysiennes; 2 espèces laissées en nomenclature ouverte.

Les espèces trouvées dans l'Atlas saharien occidental complètent celles décrites par Bassoullet & Damotte (1969). Celles du Bassin du Guir, plus nombreuses, sont plus proches de celles du Bassin d'Errachidia-Boudnib-Erfoud au maroc.

In : Revue de Paléobiologie (Genève); vol. 35, n° 1, 2016, p. 249-277.

30: Origine et radiation initiale des chauves-souris modernes: nouvelles découvertes dans l'Eocène d'Afrique du Nord. RAVEL A., ADACI M., BENSALAH M. , CHARRUAULT A.-L., ESSID E., AMMAR H.KH., MARZOUGUI W., MAHBOUBI M., MEBROUK F., MERZERAUD G., VIANEY-LIAUD M., TABUCE R., MARIVAUX L

Mots-clés: Chiroptera; Radiation; Eocène; Cladistique; Paléobiogéographie; Genres nouveaux; Espèces nouvelles; Algérie; Tunisie; Afrique du Nord

Résumé: Cette étude intègre des faunes inédites de chiroptères fossiles découvertes lors de plusieurs campagnes de terrain réalisées en Afrique du Nord. Il s'agit de localités fossilifères datées de l'Eocène inférieur à moyen de Tunisie (Chambi) et d'Algérie (Glib Zegdou). Les différentes analyses systématiques et cladistiques réalisées sur ce matériel fossile, essentiellement constitué de dents isolées, ont permis d'apporter de nombreux éclaircissements sur les modalités évolutives de la radiation des premiers microchiroptères modernes. Ces nouvelles faunes ont livré pas moins de huit nouveaux taxons répartis dans cinq familles modernes bien identifiées: un Necromantidae (?Necromantis fragmentum Ravel, n.sp.), deux Hipposideridae Miller, 1907 (?Palaeophyllophora tunisiensis Ravel, n.sp. et Hipposideros (Pseudorhinolophus) africanum Ravel, n. sp.), trois Emballonuridae Gervais in de Castelnau, 1855 (Vespertiliavus kasserinensis Ravel n. sp., ? Vespertiliavus aenigma Ravel, n. sp., et Pseudovespertiliavus parva Ravel n. gen., n.sp .), un Nycteridae (Khoufechia gunnelli Ravel n.gen., n. sp.) ainsi qu'un Vespertilionidae indéterminé. Deux autres taxons sont également répertoriés (Chambinycteris pusilli Ravel n. gen., n. sp. et Drakonycteris glibzegdouensis Ravel n. gen., n. sp.), mais leur morphologie dentaire originale ne permet pas de les attribuer de manière formelle à des familles connues. Deux analyses cladistiques permettent de clarifier les positions phylogénétiques des taxons les mieux documentés. Par ailleurs, elles mettent en évidence l'existence d'un axe majeur de dispersion des chiroptères Hipposideridae et Emballonuridae depuis l'Afrique du Nord vers le Sud de l'Europe durant l'Eocène moyen.

In: Geodiversitas; vol. 38, n° 3, 2016, p. 355-434.

31: Serpukhovian coral assemblages from Idmarrach and Tirhela formations (Adarouch, Morocco). RODRIGUEZ S., SAID I., SOMERVILLE I.D., COZAR P., CORONADO I.

Keywords: Rugosa; Tabulata; Palaeogeography; Biostratigraphy; Palaeoecology; Mississippian; Adarouch; Morocco; North Africa

Abstract: The Serpukhovian coral assemblages from Idmarrach and Tirhela formations (Adarouch, Morocco) have been studied. The yielded quite diverse assemblages with a total of 32 rugose and 1 tabulate species. The distribution of corals in the sections Idmarrach 1, 2, 3, and 4 and Tirhela 1 and 2 has been established, which include Serpukhovian and Bashkirian rocks. The Serpukhovian assemblages are composed mostly of species that have their higher abundance in the upper Viséan. However, most of the recorded taxa in Adarouch have been already mentioned in Serpukhovian rocks from Britain, Moscow basin, Urals, Donets basin and other North African regions such as Tindouf and Béchar. Thus, their stratigraphic range is not expanded. The coral diversity is mainly concentrated is biostromes from the Idmarrach 1 section. However, the high total diversity is due to the combination of favourable depositional settings and a mixture in different beds of several ecological environments, such as coral shoals, protected lagoons and microbial mounds.

Most Serpukhovian species have been recorded in areas from the western Palaeotethys previously mentioned. The total assemblage can be considered as typical for the late Mississippian in the western Palaeotethys. However, a small degree of isolation is registered by the absence in the Serpukhovian from Adarouch of the genera Lonsdaleia, Actinocyathus, Tizraia and Kizilia that have been recorded in other North African basins. That fact may be explained by the incipient rising of some areas as 'highs' due to the start of the collision between Gondwana and Laurasia.

In: Geologica Belgica; vol. 19, n° 1-2, 2016, p. 29-42.

32: Morphological trends and new species of Cyphaspis (Trilobita, Otarioninae) in the Devonian of Morocco, Turkey, Germany and Belgium. VAN VIERSEN A.P., HOLLAND D.

Keywords: Systematic palaeontology; Aulacopleuridae; Devonian; Morocco; Germany; Belgium; Turkey.

Abstract: New species of the otarionine trilobite Cyphaspis are recorded from Pragian to Givetian localities in Morocco and Belgium. The material carries a wealth of new insights into the diversity of Cyphaspis during the Devonian. In an attempt to bring structure to the vast assortment of species, selected taxa are clustered into three informal groups that need to be validated in future analyses: the agayuara group for Siluro-Devonian species that retain a "primitive" morphology, the hamidi group for comparatively small, Emsian to Eifelian species with convergences on Otarion, and the ceratophthalmus group which encompasses the type species of Cyphaspis, C. ceratophthalmus (Goldfuss, 1843), and similar species. Morphological trends in each of the groups are briefly elaborated on. Twelve new species are recorded from Morocco: C. bluhmi sp. nov., C. eximia sp. nov., C. foumzguidensis sp. nov., C. heisingi sp. nov., C. ihmadii sp. nov., C. Juergenhollandi sp. nov., C. khraidensis sp. nov., C. kippingi sp. nov., C. lerougei sp. nov., C. maharchensis sp. nov., C. smeenki sp. nov., C. tadachachtensis sp. nov. One additional species, C. boninoi sp. nov., is recorded from Belgium. Topotypical material of C. ceratophthalmus from Germany and the holotype of C. goerlichi (Haas, 1968) from Turkey are illustrated for comparisons to the other species. The holotype of C. ceratophthalmus could not be traced and a neotype is designated.

In: Geologica Belgica; vol. 19, n° 3-4, 2016, p. 251-271.

PETROLOGIE

33: Petrology, mineralogy, and P-T path of calc-silicate granulites and fassaite-marbles from the Paleoproterozoic Gour Oumelalen area (Central Hoggar, Algeria). BOUREGHDA N., OUZEGANE KH., BENDAOUD A., ÂÏT-DJAFER S., KIENAST J.-R.

Keywords: Calc-silicate granulites; Fassaite; Anticlockwise P-T path; Gourg Oumelalen; Hoggar; Algeria.

Abstract: The Gour Oumelalen area exposes Paleoproterozoic (1.9 Ga) marbles and calc-silicate granulites. Some marbles show a specific mineralogy characterized by the presence of a highly aluminous clinopyroxene with Al_2O_3 content exceeding 16 wt%. This clinopyroxene shows a marked zoning with a hedenbergitic core rimmed by fassaite.

Phase relations are expressed by spectacular reaction textures in calc-silicates granulites as Opx + Cpx + P1 + H_2O == > Grt + Qtz ± Am and Cpx + I1m + P1 ± Mt = > Grt + Qtz + Spn. In olivine-bearing marbles, clinopyroxene and dolomite occur around olivine and calcite. According to thermodynamic modeling in the Na_2O-CaO-FeO-MgO-$A1_2O_3$-SiO_2-H_2O-TiO_2-Fe_2O_3 (NCFMASHTO) system, the first stage of metamorphism is located at 800 °C and 6-7 kbar, which is followed by an increase in pressure at 9-10 kbar and 800 °C and an isobaric,cooling at 690 °C. The deduced anticlockwise P-T path is consistent with a granulitic metamorphism occurring in an active continental margin context.

In: Arabian Journal of Geosciences; vol. 9, n° 7, 2016, 492-17 p.

34: Paleoproterozoic structural frame of the Yetti domain (Eglab shield, Algeria): emplacement conditions of the Tinguicht late pluton from magnetic fabric study. MERABET N.-E., MAHDJOUB Y., HENRY B., ABTOUT A., MAOUCHE S., KAHOUI M., LAMALI A., AYACHE M.

Keywords: Plutons; Paleoproterozoic; AMS; Emplacement; Shear zones; Yetti-Eglab shield; Algeria; West African craton.

Abstract: The Tinguicht pluton is part of the ~2.07 Ga post-collisional magmatic suites that intruded the Yetti Paleoproterozoic volcano-sedimentary series of the western part of the Eglab shield (West African craton). It represents one of the most recent units of these suites. This pluton, with a NW-SE elliptic shape, is unfoliated, and its deformational structures are practically restricted to fracturing and faulting. New structural, microstructural and aeromagnetic data are presented in order to analyze in particular the relationship between the Tinguicht pluton emplacement and the related NNW-SEE major mega-shear zone, separating the Yetti and Eglab domains. To constrain the context of the regional post-collisional evolution of the Eglab shield, a structural analysis was performed by mapping the magnetic structures (foliation and lineation) using AMS. The combination of the results of all the used approaches leads to a new and enriched image of this granitic pluton and of its tectonic emplacement context. The elliptic shape of the granitic body and the AMS strain pattern are consistent with the presence of a NNW-SSE major structure. NNW-SSE is also one of the major directions highlighted by the aeromagnetic data. This study thus evidences the role of the pre-existing major shear zones in controlling emplacement of post-collisional Paleoproterozoic plutons like Tinguicht, as shown for Drissa pluton in the Eglab domain earlier.

In: Journal of African Earth Sciences; vol. 114, 2016, p. 158-173.

35: Impact-generated carbonate melts in the Talemzane impact structure (Laghouat, Algeria). SAHOUI R., BELHAI D., JAMBON A.

Keywords: Impact; Shock effects; Carbonates; Melting; Immiscibility; Talemzane; Laghouat; Algeria.

Abstract: The 1750-m-diameter, bowl-shaped Talemzane impact structure in Algeria is emplaced in Senonian or Eocene flint-beariing limestones. Field studies reveal a thin layer of light-colored polymict breccia with rounded, dark inclusions beneath a limestone megablock zone located at the top of the crater rim. The matrix of the rounded, dark inclusions consists of Si-rich glass and microcrystalline calcite. The latter is characterized by high contents of Si and Al suggesting rapid crystallization of the calcite from a melt. Backscattered electron imagery shows textural evidence for liquid immiscibility between the $CaCO_3$-rich and Si-rich glass of the matrix in the form of intermingling of calcite with Si-rich glass, coalesced blebs within silicate glass, individual calcite blebs within Si-rich glass, carbonate spherical globules in fresh Si-rich-glass, and sharp menisci between silicate and calcite blebs. These features are interpreted as evidence of impact melting of limestone and flint. The low totals of the Si-Al-Mg-rich glasses suggest that they contain significant amounts of volatiles. X-ray diffraction analyses indicate partial alteration of the Si-Mg-Al-rich glass to phyllosilicates.

In: Arabian Journal of Geosciences; vol. 9, n° 14, 2016, 641-8 p.

MINERALOGIE

36: The effect of heating on mineral composition and grain size distribution of flux calcined porcelanites from the Gafsa-Metlaoui basin, southwestern Tunisia. SAIDI R., TLILI A., JAMOUSSI F.

Keywords: Porcelanite; Thermal treatment; Mineralogy; Grain size distribution; Gafsa-Metlaoui basin; Tunisie

Abstract: The porcelanite rock of Ypresian phosphatic series of the Gafsa-Metlaoui basin (South-Western Tunisia) is composed mainly of opal CT, and presents a variable percentage of carbonates and fibrous clays. This rock is treated with flux calcination at different temperatures in order to prepare a specific filter aid for cleaning melting sulfur which can be used for the production of sulfuric acid. This work presents the effect of heating on the mineralogy and grain size distribution of carbonate-rich porcelanite (Tm1) and clay-rich porcelanite (Gh) compared to flux calcined silica-rich porcelanite (CHM3) and diatomaceous filtration aids. The porcelanite samples used in this work come from three localities of the Gafsa-Metlaoui basin: Kef El Ghis (Gh), Tamarza (Tm1) and Mides (CHM3). Flux calcinations at 1000 °C provokes a mineralogical transformation on carbonate-rich porcelanite samples. The opal CT transforms to opal C and becomes neater and more stable. The thermal treatment of porcelanite (Tm1) incites also the apparition of news peaks of wollastonite. However, the structural change of opal CT to opal C by heat treatment is blocked for flux calcination of clay-rich porcelanite. The opal CT of fluxing clay-rich porcelanite becomes more ordered without significant change to opal C. The difference between fluxing carbonate-rich porcelanite (Tm1) and fluxing clay-rich porcelanite (Gh) appears also with granulometric distribution histogram of the tow heated sample. All raw samples have unimodal granulometric distribution (1-100 µm). After calcinations with alkaline flux at 1000 °C fluxing carbonate-rich porcelanite displays bimodal granulometric distribution and a new mode appears systematically, between 0.1 µm and 1 µm. This occurs for fluxing silica-riche porcelanite and diatomaceous filtration aids as well and corresponds to the opal C formed after heat treatment. Whereas fluxing clay-rich porcelanite present trimodal granulometric distribution and a third mode appears (100-300 µm), which due to silica glass phase. Since, the granulometric rearrangement of porcelanite during thermal treatment may due to mineralogical transformation of opal CT of opal C and crystal grow.

In: Journal of African Earth Sciences; vol. 124, 2016, p. 189-198.

GEOLOGIE MINIERE

37: Les territoires miniers. Exploitation et reconquête. DESHAIES M.

Mots-clés: Ressource; Activité minière; Exploitation minière; Industrie minière; Paysages miniers; Régions minières; Aspect environnementale; Développement durable.

Résumé: L'exploitation minière a façonné des territoires aux paysages originaux, qui se différencient en fonction des techniques d'extraction employées et des conditions géopolitiques et économiques dans lesquelles elle a évolué. L'essor fantastique des activités minières au XXe siècle est marqué par l'extension de grandes exploitations à ciel ouvert. L'échelle de cette exploitation change profondément les paysages et l'environnement des territoires où elle se développe et est à l'origine des conflits opposant sociétés minières et populations locales luttant, au nom du développement durable, contre les projets d'extension des mines. Ces paysages évoluent en fonction des modalités du déclin de l'activité minière et du processus de reconquête du territoire qui lui succède. La variété des évolutions, entre abandon et réhabilitation, est à l'origine de paysages différents, où les héritages de l'exploitation minière demeurent plus ou moins présents. On peut ainsi distinguer des paysages post-miniers, à forte valeur patrimoniale, et des paysages de succession minière, où ne subsiste plus aucune trace visible de l'ancienne activité minière. L'ouvrage montre ainsi l'importance des transformations de la surface de la terre par l'homme et l'étude la question des relations entre exploitation des ressources, environnements et développement durable.

In: Coll. Carrefours. Ed. Ellipses; 2007, 224 p.

38: Essentials of mineral exploration and evaluation. GANDHI S.M., SARKAR B.C.

Keywords: Metals; Minerals; Mineral deposits; Prospecting; Remote sensing; Geophysical exploration; Geological exploration; SIG; Reserve; Mineral resources classification.

Abstract: An up-to-date reference covering the state-of-the-art techniques in mineral exploration and associated activities such as drilling, sampling, estimation, and evaluation;

- Covers the complete spectrum of all aspects of mineral deposits, prospecting, and the like, providing a "one-stop shop" for students and experts

- Presents the most relevant information on the latest developments and methods in all areas of mineral exploration

- Includes chapters on application of GIS, statistics, and geostatistics in exploration and evaluation of mineral deposits

Essentials of mineral exploration and evaluation offers a through overview of methods used in mineral exploration campaigns, evaluation, reporting, and economic assessment processes. Fully illustrated to cover the advanced exploration techniques and evaluation of mineral assets being practiced globally, this current reference offers balanced coverage of the latest knowledge and current global trends in successful mineral exploration and evaluation. From mineral deposits to remote sensing to sampling and analysis, essentials of mineral exploration and evaluation delivers an extensive look at this rapidly changing field and provides a valuable resource for geologists, mineralogists, mineral explorationists, graduate students in mineral exploration departments, and the like.

In: Ed. Elsevier; 2016, 406 p.

39: Pb-Zn (Ba) deposits of the oriental Saharan Atlas (north-east of Algeria): distribution, control and implications for mining exploration HADDOUCHE O., BOUTALEB A., CHAMAM M., YSBAA S., HAMMOUCHE H., BOUBAYA DJ.

Keywords: Mineral deposits; Mineralization; Tectonic; Geophysical; Exploration; Oriental Saharan Atlas; Algeria.

Abstract: Analysis and integration of geological/metallogenic data and digitally processed gravimetric/ aeromagnetic data to the oriental Saharan Atlas domain were carried out to understand the spatial distribution and structural control on Pb-Zn (Ba) deposits of the oriental Saharan Atlas. The use of this combined technique suggests that most of mineral deposits appear to be regionally controlled by structural trends (subparallel NE-SW-trending) along margins of subsiding sedimentary basins. Mineralization occurs along or near major NE-SW-trending faults, locally intersected by NW-SE-trending faults. In addition, mineral deposits are usually either inside anticlinal hinge zones (example, Merouana, Ichmoul and Ain Mimoun ore deposits) or on the flanks of anticlinal structures (example, Ain Bougda ore deposit). In "diapiric zone", mineral deposits are generally located on diapiric structures borders (peridiapiric concentrations), related to NE-SW/NE-SW and E-W-trending faults. Other mineral concentrations occurs along the margins of tectonic troughs zones (example, Morsott trough) resulting probably by NW-SE-trending deep faults movement. In summary, our research suggested that regional parameters, such as NE-SW/NW-SE-trending lineaments, intersections of these lineament zones and margins of subsiding sedimentary basins/diapiric structures, serve as significant indicators and provides a valuable framework for guiding the early stages of Pb-Zn (Ba) mineral exploration; other considerations must then be applied in this region, like integration of surficial geochemical anomalies that allows better delineation of targets for further mineral exploration.

In: Arabian Journal of Geosciences; vol. 9, n° 5, 2016, 422 – 10 p.

40: Metallogenic evolution of uranium deposits in the Middle East and North Africa deposits. HOWARI F., GOODELL PH., SALMAN A.

Keywords: Uranium; Metallogenic; MENA; Middle East; North Africa.

Abstract: This paper is briefly involved in classification and distributions of the Middle East and North Africa (MENA) uranium deposits. The study of these mineral systems can significantly contribute to our further understanging of the metallogeny of known and poorly explored deposits. This provides contribution to, and further enhancement of, current classifications and metallogenic models of uranium systems, allowing researchers to emphasize on unknown or poorly studied mineral systems found in MENA. The present study identified eight metallogenic types of uranium associated with: 1) the Archean rocks and intracratonic basins, 2) the Pan-African granites and rhyolites which are characterized by igneous activity, 3) Phanerozoic (Paleozoic) clastics, these deposits are the sedimentological response to Pan African magmatism, 4) Mesozoic (basal) clastics type e.g. Nubia sandstones which are characterized by uranium minerals, 5) regional sedimentary phosphate deposits which are categorized as geosynclinal, or continental margin deposits, on the shelf of the Tethys Ocean, 6) Cenozoic intracratonic felsic magmatism of the Tibesti and Hoggar, and the sandstone U deposits of adjoining Niger. These are similar to the Pan-African magmatism metallogenic,

7) Calcretes and 8) Resistate minerals which are often enriched in rare earth elements, sometimes including uranium. They are thus sometimes considered as U resources but poorly explored in the MENA region. These metallogenic types are described and discussed in the current paper.

In: Journal of African Earth Sciences; vol. 114, 2016, p. 30-42.

41: The vein-type barite mineralization of the Draïssa ore field, Ougarta ; SW- Algeria: mineralogy, trace elements and halogens. SEMCHAOUI A.A., KOLLI O., BOUTALEB A.

Keywords: Barite mineralization; REE; Halogens; Draîssa deposits; Ougarta; Algeria.

Abstract: The Draïssa barite vein system in the Ougarta district is located in southwestern Algeria. It is the principal mineral deposit of economic interest of the area. The mineralization is hosted by Cambrian sedimentary rocks that unconformably overlie Precambrian formations. The mineralized structures consist mostly of barite and quartz with minor sulfide minerals and trend dominantly NE-SW, NW-SE, and E-W. Siliceous alteration zones are associated with the vein system. Samples of barite ore are characterized by low total REE contents ranging from 9 to 50 ppm and positive Eu (2-2.15 ppm) and Y (1.2-11.1 ppm) anomalies, indicating hydrothermal activity during mineralization. Halogen data of the barite show that the C1/Br molar ratio is 189:571 and the Na/Br ratio is 34:376, indicating that the sulfur was derived from seawater. The Ba-enrichment trend in the volcanic rocks of Draïssa is interpreted as possible probable source of the Ba (424-3039 ppm Ba). It appears that the barite-quartz deposits were formed in two stages. Endogenous fluids deposits the primary vein materials, consisting of quartz associated with copper sulfides. Exogenous fluids (cold seawater) became heated during ascendant fluid movement. Mineralization was governed by convective motions and the barite and galena fillings were deposited in openings created by normal faulting.

In: Arabian Journal of Geosciences; vol. 9, n° 16, 2016, 679-16 p.

42: GIS-based weights of evidence modeling applied to mineral prospectivity mapping of Sn-W and rare metals in Laouni area, Central Hoggar, Algeria. ZEGHOUANE H., ALLEK K., KESRAOUI M.

Keywords: Geomatic modeling; GIS; Prospectivity modeling; Weights of evidence; Mineral exploration; Rare metals; Hoggar; Algeria.

Abstract: The development in the emerging technologies of information and communications requires more rare metals. The existing resources, insufficient to assume this progress, require further investigations to discover new rare metal deposits. The traditional methods, based on manual overlay, are unsuitable and expensive. Thus, mineral exploration requires updated methods to easily, quickly, and cost effectively delineate new promising exploration zones. Geographical Information System (GIS) and applied geomatics provide and perfect various modeling techniques implemented in GIS software. In recent years, two spatial modeling techniques were developed and widely, applied in mineral exploration, data-driven methods, and knowledge methods. Weight of evidence (WofE) is a data-driven method based on the Bayesian theorem and its fundamental concept of prior and posterior probabilities. The method combines statistically diverse geodata that represent ore-controlling factors by weighting their evidence using “control points” to create a “posterioir probalility map.” Our study area, located at the southern part of Hoggar in the south of Algeria, is potential for Sn, W, and rare metals and encloses several deposits related to peraluminous post-orogenic rare metal granitoîds (RMGs). In this work, “weights of evidence” modeling is applied to map mineral potential of this style of mineralization. Seventeen predictor maps, representing the deposit recognition criterion model, were generated from multi-source geodata (lithology, geochemistry, tectonic, magmatism, and geophysics). These data were used as “input data” and the known deposits (48 mineral occurrences) as “training sites.” The WofE modeling gets the following results: (1) generate an output map called “mineral potential map” (MPM), where potential zones are reduced to small areas; (2) the MPM efficiently predicts the well-known deposits of Nahda, Sedis, Rechla, and Tit N’Enir; and (3) highlights some unrecognized areas such as Tedjrine, Monts de Tessalit, and Gara Akeboum. (4) The control model demonstrates the possibility to extend the WofE method to the adjacent regions enclosing a small number of known mineral deposits.

In: Arabian Journal of Geosciences; vol. 9, n° 5, 2016, 373-13 p.

43: Geochemistry and U-Pb zircon geochronology of the pegmatites in Ede area, southwestern Nigeria: a newly discovered oldest Pan African rock in southwestern Nigeria. ADETUNJI A., OLAREWAJU V.O., OCAN O.O., GANEV V.Y., MACHEVA L.

Keywords: Pegmatites; U-Pb geochronology; Ede; Nigeria; Pan African.

Abstract: Field and petrographic studies, whole rock geochemistry and in-situ LA-ICP-MS geochemical and isotopic U-Pb measurements on zircons have been performed on granitic pegmatites of Ede area, southwestern Nigeria with a view to characterize them, determining their mineralization potentials, petrogenetic attributes and emplacement age. The pegmatites are hosted by migmatite gneiss complex biotite muscovite schist and associated quartzite. The textural and mineralogical characteristics of these pegmatites indicate the occurrence of two main varieties, namely, muscovite pegmatite and garnet pegmatite. Of less importance are inclusions and pods of graphic granite, quartz-microcline aplitic and pegmatitic bodies. At the present level of erosion, the parent igneous rocks of the pegmatites are not exposed. The two dominant pegmatite varieties show slightly different chemical peculiarities but similar peraluminous character. The average K/Rb ratios of 165 and 163, respectively, for muscovite and garnet pegmatites combined with other trace element compositions are indicative of affinity to muscovite class of pegmatite which are generally not promising for rare elements mineralization. However, the unusually high concentration of bismuth in the zircons indicates Bi mineralization in the area which can either be in the pegmatites or host rocks.

The Nb/Ta ratios for both muscovite and garnet pegmatites range from 0.7 to 15.2 and 1.0 to 14.8, respectively. These Nb/Ta ratios and Eu anomalies are statistically similar for both pegmatites. These probably indicate the pegmatites crystallized from a common source but separated into crystallization paths that produced different pegmatite varieties through liquid-liquid immiscibity mechanism. In-situ measurements of REE, P, Y, Nb, Hf, Ta, Bi, Th and U of individual zircon grains show the existence of two chemically and texturally different domains which are indicative of alteration that may be due to interface-coupled dissolution-precipitation promoted by microfractures induced by metamictization. Notwithstanding, the $(Sm/La)_N$ vs. La plot for zircon, weak positive Ce and variable europium anomaly (Eu*) are suggestive of pegmatites of hydrothermal origin. The pegmatites yielded a discordant U-Pb zircon age with upper concordia intercept of 709 +27/-19 (at 2σ, MSWD = 1.5) Ma which can be attributed to their emplacement. This age represents the oldest Pan African magmatic event reported so far in southwestern Nigeria.

In: Journal of African Earth Sciences; vol. 115, 2016, p. 177-190.

44: Carbon and oxygen isotope variations of the Middle-Late Triassic Al Aziziyah formation, northwest Libya. MOUSTAFA M.S.H., POPE M.C., GROSSMAN E.L., MRIHEEL I.Y.

Keywords: Carbon and oxygen isotope; Ghryan dome; Kaf bates; Jifarah basin; Al Aziziyah formation; Libya.

Abstract: The study presents the $\delta^{13}C$ and $\delta^{18}O$ records from whole rock samples of the Middle-Late Triassic (Ladinian-Carnian) Al Aziziyah formation that were deposited on a gently sloping carbonate ramp within the Jifarah basin of Northwest Libya. The Al Aziziyah formation consists of gray limestone, dolomite, and dolomitic limestone interbedded with shale. The Ghryan Dome and Kaf Bates sections were sampled and analyzed for carbon and oxygen isotope chemostratigraphy to integrate high-resolution carbon isotope data with an outcrop-based stratigraphy, to provide better age control of the Al Aziziyah formation. This study also discusses the relation between the facies architecture of the Al Aziziyah formation and the carbon isotope values. Seven stages of relative sea level rise and fall within the Ghryan Dome were identified based on facies stacking patterns, field observations and carbon stable isotopes. The Al Aziziyah formation $\delta^{13}C$ chemostratigraphic curve can be partially correlated with the Triassic global $\delta^{13}C$ curve. This correlation indicates that the Al Aziziyah formation was deposited during the Ladinian and early Carnian. No straight-forward relationship is seen between $\delta^{13}C$ and relative sea level probably because local influences complicated systematic environmental and diagenetic isotopic effects associated with sea level change.

In: Journal of African Earth Sciences; vol. 118, 2016, p. 149-162.

45: Statistical and geostatistical analysis related to geographical parameters for spatial and temporal representation of rainfall in semi-arid environments: the case of Algeria. BACHIR H., SEMAR A., MAZARI A.

Keywords: Average yearly rainfall; Multiple linear regression; Geographical parameters; Geostatistic; GIS; High plateaus of Algeria.

Abstract: The economic challenges related to the fields of agriculture and industry led us to adopt the best suited method to represent the rain on the spatial and temporal plan especially in areas characterized by heterogeneous rainfall distribution additionally to drought periods. The methods of analysis and estimation of rainfall, using a number of tools (statistics, geostatistics and digital mapping), provide the opportunity to represent the average inter-yearly rainfall fields in the eastern high plateaus region of Algeria. In this study, an approach was proposed for yearly rainfall characterization. Data series for the period 1986-2007 were collected from 65 rain-gauging stations. This approach is based on two combined methods (geostatistic and multiple linear regression) including direct relationship between rainfall and geographical parameters (longitude, latitude and altitude). Statistical analysis indicates that the annual rainfall values ranges from 127 to 752.2 mm and that their distribution is platykurtic. Results show that yearly rainfall structure obeys mainly a north/south gradient, and latitude is the most influential geographical parameter with a coefficient of 261.25 contrary to the longitude (17.06) and altitude (0.04) which have a non-significant effect on precipitation. In addition, other factors such as vegetation, temperature and air mass movement affect negatively the rainfall structure. Moreover, the map of rainfall indicates that the rain bands ranging from 300 to 400 mm dominate 58 % of the total study area whereas rain bands greater than 400 mm occupy 37 % of the total study area.

In: Arabian Journal of Geosciences; vol. 9, n° 7, 2016, 486-12 p.

46: Multivariate statistical analysis of the groundwater of Ain Djacer area (Eastern of Algeria). BENCER S., BOUDOUKHA A., MOUNI L.

Keywords: Multivariate statistical; Principal component analysis; Cluster analysis; Hydrochemistry; Groundwater; Algeria.

Abstract: The intensive exploitation of groundwater resources in the region of Ain Djacer has greatly influenced the hydrochemical functioning of the superficial aquifer. This has resulted in a general decline of the piezometric level of the groundwater, a mineralization of water and calcium facies near limestone and sodium chloride in the center of the plain in liaison with the lithology. To highlight the hydrochemical processes of groundwater, a study by major ions were analyzed in 21 groundwater samples collected from this aquifer during the month of March 2004. Multivariate statistical techniques and cluster and principal component analysis were applied to the data on groundwater quality, with the objective of defining the main controls on the hydrochemistry at the plain. These statistical techniques have shown the presence of three salinity groups with increasing importance according to the direction of flow. The initial facies on the limits as well as infiltration areas is bicarbonate. In the center of the plain, water becomes charged with sodium (Na) and chlorine (C1) in connection with the dissolution of salt formations. The presence of nitrates is related to agricultural activity.

In: Arabian Journal of Geosciences; vol. 9, n° 4, 2016, 248-10 p.

47: Physicochemical quality of groundwater and pollution risk in arid areas; the case of Algerian Sahara. KENDOUCI M.A., KHARROUBI B., MEBARKI S., BENDIDA A.

Keywords: Arid climate; Groundwater; Physicochemical parameters; Relation river-aquifer; Pollution; Algerian Sahara.

Abstract: In urban areas, population growth generates significant amounts of wastewater which are treated in specialized treatment stations or rejected directly without control in the case of short water Bechar river. Because of their diverse backgrounds, these waters are often loaded with organic elements, minerals, and microorganisms; some of which could be harmful to health and is heavily involved in the degradation of groundwater that may be irreversible.

The study was conducted on two boreholes located next to the Bechar river (North and South) by influencing wastewater localized on the course of the Bechar river. A work plan has been adopted; it is early to make a monthly monitoring of two wells during the period from January 2007 to April 2014, with a comprehensive analysis of physicochemical parameters, to determine the various anthropogenic contributions to polluting nature in the region and analyze their physicochemical composition, to explain the origin and evolution of each element. The analyses revealed the levels of CI, NO_3, NO_2, NH_4, and phosphates that can be passed to the groundwater by the water surface runoff of the river, the wastewater undergoes a slow percolation through the layers Triassic. This is confirmed by the high levels of chlorides, ranging from 180 mg/1 in 2007 to 216 mg/1 in 2014 for drilling north and 199 to 336 mg/1 for drilling south of the river, which explains the values of the conductivity of 990 µS/cm ranging up to 1050 µS/cm. Nitrate concentrations ranged from 11 mg/1 to 28 mg/1 for the drilling located north of the river.

In: Arabian Journal of Geosciences; vol. 9, n°2, 2016, 146-6 p.

48: Uncertainty analysis of HEC-HMS model using the GLUE method for flash flood forecasting of Mekerra watershed, Algeria. LEHBAB-BOUKEZZI Z., BOUKEZZI L., ERRIH M.

Keywords: Uncertainty analysis; Mekerra; HEC-HMS; GLUE; Mekerra; Algeria.

Abstract: In this paper, the lumped quasi-distributed hydrological model HEC HMS is used to simulate the rainfall-run-off process of the Mekerra watershed, located in the northwest of Algeria. The model parameters' uncertainty and the predictive intervals were evaluated with the generalized likelihood uncertainty estimation (GLUE) approach. According to the results, good simulations were obtained with different values of variables for many sets of parameters generated randomly by the Monte Carlo procedure, which is known as Equifinality. After the analysis, only the hydraulic conductivity at saturation parameter appears well defined, taking values within a limited range. In addition, results indicated that combinations of likelihood measures associated with multiple and different periods of observations reduce a posterior uncertainty of estimated parameters and predictive intervals in some degree. Overall, the GLUE analysis showed that there is a significant uncertainty associated with hydrological modelling of watershed Mekerra, to a great extent due to multiple sources of errors.

In: Arabian Journal of Geosciences; vol. 9, n° 20, 2016, 751-12 p.

49: Hydrogeochemical and stable isotope data of groundwater of a multi-aquifer system: Northern Gafsa basin – Central Tunisia. MOKADEM N., DEMDOUM A., HAMED Y., BOURI S., HADJI R., BOYCE A., LAOUAR R., SAAD A.

Keywords: Groundwater; Multi-aquifer system; Dissolution; Isotopic composition; Northern Gafsa; Tunisia; North Africa.

Abstract: The hydrodynamic of the multi-aquifer system (the Continental Intercalcaire "C.I" and the Compex Terminal "C.T") of the North Gafsa basin is largely determined by tectonics (Tebessa – Gafsa fault). The composition of groundwater is controlled by complex reactions at gas-liquid-solid "mineralogical composition of associated rocks" interfaces, which depend on the natural surrounding and potential anthropogenic impact. The hydrochemical data (major ion geochemistry) indicate that these groundwaters are characterized by the dominance a Ca-Mg-HCO_3/SO_4 and Na-C1-NO_3 water types. Geochemical pattern is mainly controlled by the dissolution of halite, gypsum and/or anhydrite as well as by the incongruent dissolution of carbonate minerals. The pH of these samples range from 6.54 to 8.89, supporting the conclusion that the H_2CO_3/HCO_3 couple control pH buffering. Oxygen-18 ($\delta^{18}O‰_{SMOW}$) and deuterium ($dD‰_{SMOW}$) isotopic data show the exchange between the groundwater and the rock (water-rock interaction) and the evaporation effect. The isotopic content of the boreholes waters is of mixed Mediterranean – Atlantic origin and is opposite to the quantity of rainwater distribution, both in space and time in the study area. This is due to its geographical situation in the southern and southwestern of the Mediterranean sea and between the Atlas area and the Sahara platform. The concentrations of the isotopic composition of the groundwater are significantly higher than the rainwater. This is indicative of the dissolution of salts and other processes modifying the rainwater geochemical composition during infiltration into the vadose zone. The hydraulic interconnection of these components of the system has led to the evolution of these interesting groundwater types.

In: Journal of African Earth Sciences; vol. 114, 2016, p. 174-191.

50: Water resources in Africa: scarcity and abundance. SEGUIN J.-J., GUTIERREZ A.

Keywords: Groundwater resource; Freshwater resources; Aquifer; Alluvial formation; Map; Basement rock; Africa.

Abstract: Where groundwater resources are concerned, a distinction should be made between the resource per se and the reserves. The resource (the recharge of aquifers by infiltration of precipitations) is dependent on flows fed by the water cycle and is accordingly largely renewable. As to groundwater reserves, these correspond to stores of water not currently replenished under present climate conditions. A special type of water reserve is represented by so-called fossil aquifers: when tapped, they can be assimilated to a mine deposit, that is, with the risk of exhaustion. The media have recently widely broadcast the estimations of a study [Mac Donald et al. (2012)] quantifying Africa's water reserves (660,000 km^3)[1]. These appear to be over 100 times more abundant[2] than the renewable resources, the latter being estimated at nearly 4000 km^3 per year (table1). The tapping potential for these aquifers is debatable from technical, economic, environmental, and even geopolitical standpoints, and poorly compatible with sustainable management, which presupposes considering only the renewable resource. However, these resources are already widely called upon, on a local basis, because reserves and renewable resources are unequally distributed across the continent. The former depend on the position of the vast geological reservoirs, while the latter are closely related to climate.

In: Geosciences- the BRGM's Journal for a sustainable earth; n° 21, 2016, p. 58-68.

GEOPHYSIQUE

51: Gravity constraints on the underground structural framework and associated volcanism of the Maghrebian allochthonous domain: the Sejnene Numidian flysch, Tunisian tell. ATAWA M., ZOUAGHI T., SOUEI A.

Keywords: Gravity; Lineaments; Tectonic framework; Numidian thrust sheets; Volcanism; Tunisia.

Abstract: Tectonic framework of the Neogene Numidian flysch is one of the primary subjects in the Tell of northern Tunisia for understanding the late Miocene kinematics around the Mediterranean basin. Belonging to the extreme North of Tunisia, this domain is marked by a confuse structuring. Much of the Sejnene area is represented by thick Neogene Numidian flysch, which is widely exhibited around the Mediterranean and directly deposited on Mesozoic and Cenozoic strata.

Gravity measurements covering the Sejnene area coupled with geological outcropping data were used to constrain the deep structural setting of the Neogene Numidian flysch and its associated volcanic outcrops. Integration of different gravity processed maps, leads us to highlight relationship between outcropping and sealed deformed structures and proposed a tectonic framework model for raised volcanic rock within the thrust sheet system. Maps resulted from gravity processing reveal structural variations marked by several geometries and oriented lineaments. The structuring suggests that the Sejnene study area is marked by two tectonic framework domains: to the North, the areas is mainly characterized by NE- and E- oriented subparallel lineaments corresponding to thrusts, reverse faults and strike slip reverse fault system. Conversely to the South, the same master trends are crossed by others NW- and N- trending transversal and deep-seated lineaments corresponding to strike slip reverse faults.

Neogene NW- then N- striking compressional phases have induced inversion of inherited structures that are fossilized by rejuvenation of ancient faults affecting the basement. The final obtained structural setting suggests South-verging evolution of the Numidian domain under low-angle decollement layer to the North and under deep-seated thrusting and strike slip movements to the South. Master strike slip movements induced rising of lithospheric volcanic rock.

Geophysical and geological study of the Sejnene area provides a new insight into tectonic framework of the Numidian flysch and the associated Mogods volcanic rocks. Structuring of this Tellian domain well correlated with orogenic episodes of the western Mediterranean and seems to be related to the Alpine orogeny.

In: Journal of African Earth Sciences; vol. 116, 2016, p. 248-263.

52: Aerogravity and remote sensing observations of an iron deposit in Gara Djebilet, southwestern Algeria. BERSI M., SAIBI H., CHARAF CHABOU M.

Keywords: Remote sensing; Landsat 8; Iron ore; Aerogravity; Gara Djebilet; Algeria.

Abstract: The Gara Djebilet iron ore region is one of the most important regions in Africa. Located in the south-western part of Algeria at the border with Mauritania, the Gara Djebilet region is characterized by steep terrain, which makes this area not easily accessible. Due to these conditions, remote sensing techniques and geophysics are the best ways to map this iron ore. The Gara Djebilet formations are characterized by high iron content that is especially rich in hematite, chamosite and goethite. The high iron content causes an absorption band at 0.88 μm, which is referred to as band 5 in the Operational Land Imager (OLI) Landsat 8 images. In this study, we integrated geological data, aerogravity data, and remote sensing data for the purpose of mapping the distribution of the Gara Djebilet iron deposit.

Several remote sensing treatments were applied to the Landsat 8 OLI image, such as color composites, band ratioing, principal component analysis and a mathematical index, which helped locate the surface distribution of the iron ore. The results from gravity gradient interpretation techniques, 2-D forward modeling and 3-D inversion of aerogravity data provided information about the 2-D and 3-D distribution of the iron deposit. The combination of remote sensing and gravity results help us evaluate the ore potential of Gara Djebilet. The estimated tonnage of the iron ore at Gara Djebilet is approximately 2.37 billion tones with 57% Fe.

In: Journal of African Earth Sciences; vol. 116, 2016, p. 134-150.

53: Electrical and well log study of the Plio-Quaternary deposits of the southern part of the Rharb basin, northern Morocco. BOUHADDIOUI M.E., MRIDEKH A., KILI M., MANSOURI B.E., GASMI E.H., MAGRANE B.

Keywords: Plio-Quaternary deposits; Tectonics & climatic factors; Geometry of deposits; Paleo-rivers; Rharb basin; Northern Morocco.

Abstract: The Rharb basin is located in the NW of Morocco. It is the onshore extension of a lager offshore basin between Kenitra and Moulay Bousselham. The Rharb plain (properly called) extends over an area of 4200 km^2 between two very different structural entities: the unstable Rif domain in the NE and the East and the "relatively stable" Meseta domain in the South. The distribution of Pliocene-Quaternary deposits under this plain is complex and was controlled by both tectonics and climatic factors. The main objective of the present work is to define the spatiotemporal evolution of these deposits in the onshore part of the basin and to make a comparison with a sequence analysis defined, for equivalent deposits in the offshore basin, by a previous work. The proposed model allows thus to characterize the geometry of these deposits in the extension of continental shelf under the present day onshore basin, and to explain there is genesis in terms of interactions between eustatic sea level fluctuations, tectonics and sedimentary rates at the mouths of paleo-rivers that had drained the Rharb plain during Pliocene to Quaternary times.

In: Journal of African Earth Sciences; vol. 123, 2016, p. 110-122.

54: Seismic reflection imaging of active faults and their tectonic behavior in the Northern Moroccan margin. Is the Nekor fault a pure strike-slip fault? BOUSKRI G., ELABBASSI M., AMMAR A., EL OUAI D., HARNAFI M.

Keywords: Active tectonics; Seismic reflection; Seismicity. Nekor fault; Rifbelt; Alboran sea; Morocco.

Abstract: The study of 1000-km seismic reflection profiles, along the Northern Moroccan margin, allowed browsing new imaging in detail about the regional geological structures and their functioning. To achieve this goal, we elaborated a high-resolution depth model and a global tectonic sketch. The influence of recent tectonic activity is manifested by normal and strike-slip faults, trending mainly 70° N and 125° N. In this segment, the Nekor strike-slip fault seems to be connected to a secondary major fault system that changes direction from 30° N to 70° N, and changing behavior to left-lateral strike-slip fault with normal component. Analysis of local seismic activity recorded from 1990 to 2014 with moderate magnitudes activity shows alignments in clear superposition with the detected active faults in seismic reflection lines.

In: Arabian Journal of Geosciences; vol. 9, n° 15, 2016, 666-10 p.

55: Discovery of a Devonian mafic magmatism on the western border of the Murzuq basin (Saharan metacraton): paleomagnetic dating and geodynamical implications. DERDER M.E.M., MAOUCHE S., LIEGEOIS J.P.

Keywords: Basic magmatism; Isotopic (K-Ar, U-Pb) dating; Paleomagnetic dating; Devonian; Murzuq craton; Saharan metacraton; Algeria.

Abstract: Intraplate deformation is most often linked to major stress applied on plate margins. When such intraplate events are accompanied by magmatism, the use of several dating methods integrated within a multidisciplinary approach can bring constraints on the age, nature and source mobilized for generating the magma and in turn on the nature of the intraplate deformation. This study focuses on the large gabbro Arrikine sill (35 km in extension) emplaced within the Silurian sediments of the western margin of the Murzuq cratonic basin in southeastern Algeria. Its emplacement is dated during the early Devonian (415-400 Ma) through the determination of a reliable paleomagnetic pole by comparison with the Gondwana Apparent Polar Wander Path (APWP). This age can be correlated with deep phreatic eruptions before Pragian time throught to be at the origin of sand injections and associated circular structures in Algeria and Libya. For the sill, the K-Ar age of 325.6 ± 7.7 Ma is related to a –rich aplitic phase that has K-enriched by more than 20% the Devonian gabbro. Laser-ICP-MS U-Pb method dates only inherited zircons mostly at c. 2030 Ma with additional ages at c. 2700 Ma and younger ones in the 766-598 Ma age range. The Arrikine sill is a high-Ti alkaline gabbro having the geochemical composition of a hawaiite akin to several intraplate continental and oceanic provinces, including the comtemporaneous Aïr ring complexes province in Niger, but also to the Mauna Loa volcano in Hawaii. This peculiar composition akin to that of the contemporaneous Aïr province is in agreement with a lower Devonian age for the Arrikine sill.

The lower Devonian Arrikine sill emplacement is related to “Caledonian” transtensive reactivation of the western metacratonic boundary of the Murzuc craton. This event also generated in the Saharan platform the so-called “Caledonian unconformity” of regional extension, the Aïr ring complexes and magmatic rocks that produced sand injections. It could be related to rifting of the Hun terranes that occurred at the plate margin to the north (Stampfli and Borel, 2002, Blackey, 2008 and references therein). The mid-Carboniferous (c. 326 Ma) reactivation corresponds to Variscan compression on NW Africa generating aplitic fluids, but also to the major “Hercynian unconformity” of regional extension. The generation of the Arrikine magma is attributed to partial melting through adiabatic pressure release of uprising asthenosphere along tectonically reactivated mega-shear zones, here bordering the relictual Murzuq craton enclosed in the Saharan metacraton.

In: Journal of African Earth Sciences; vol. 115, 2016, p. 159-176.

56: Integration of magnetic, gravity, and well data in imaging subsurface geology in the Ksar Hirane region (Laghouat, Algeria). FARHI W., BOUDELLA A., SAIBI H., BOUNIF M.O.A.

Keywords: Gravity; Magnetic; Modeling; Inversion; Ksar Hirane; Laghouat; Algeria.

Abstract: Gravity and magnetic surveys, comprised of data from 985 gravity stations and 1373 magnetic stations, were recorded in the Ksar Hirane region in Laghouat, Algeria from May-August 2011 to study the poorly understood thickness of the sedimentary rocks and the structure of the basement rocks. The Bouguer anomalies vary from -48 mGal (northwest) to -58 mGal (southeast) and the magnetic intensities from 42,094 nT (northwest) to 42,344 nT (southeast).

The constrained two-dimensional (2-D) forward modeling, three-dimensional (3-D) inversion of measured gravity and magnetic datasets helped us highlight the structure of the basement rocks at Ksar Hirane and determine the thichness of the sedimentary cover.

Prominent NE-SW-trending geophysical anomalies that affect the study area were revealed by potential field gradient methods and were in agreement with the geological structure trends.

The 3-D constrained inversion of magnetic data showed magnetized Precambrian metamorphic basement rock at shallow depths (approximately 3 km) in the southeast region and deeper (>10 km) in the northwestern part of the region, presenting similar results to that of the 2-D forward modeling of gravity and magnetic data. The inverted gravity data explain the structural architecture of the Ksar Hirane area, dissected by NE-SW sub-vertical faults.

In: Journal of African Earth Sciences; vol. 124, 2016, p. 63-74.

57: Application of 3D Euler deconvolution and improved tilt angle in the aeromagnetic data of In Ouzzal terrane, Western Hoggar, Algeria. HARROUCHI L., HAMOUDI M., BENDAOUD A., BEGUIRET L.

Keywords: Euler deconvolation; Improved tilt angle; Aeromagnetic data; In Ouzzal terrane; Hoggar; Algeria.

Abstract: The study area is located in the western Hoggar shield (southern Algeria). It includes the In Ouzzal terrane, which consists of Archaean metamorphic rocks. By contrast to other rocks of the Hoggar shield, the In Ouzzal terrane represents an exception of being neither deformed nor metamorphosed during the Pan-African event, remaining as a rigid block since 2 Ga. Although, previous geophysical works in the area include an airborne magnetometer and gamma-ray spectrometric survey as well as ground gravity and magnetotelluric survey structurally, the study area has not been very well understood. In this paper, we present the interpretation results of the airborne magnetic data by using the 3D Euler deconvolution and the improved Tilt-angle methods. These results reveal the existing of fault systems (FS) occurring within the center of the study area and along the latitude of 22; the results also suggested that the deepest fault system is oriented NE-SW and is represented by parallel major faults splitting the In Ouzzal terrane into two different parts: northern and southern. The northern part moved northwards, whereas the southern part moved southwards colliding with the Iforas unit. The interpretation confirms that the In Ouzzal terrane and the surrounding Pan-African structures are bound two by two sub-vertical lithospheric faults with the existence of dextral and sinistral faults in the west and east of the terrane, respectively.

In: Arabian Journal of Geosciences; vol. 9, n° 7, 2016, 508-11 p.

58: Multiscale analysis of gravity data using the 2D directional continuous wavelet transform with a case study from Hoggar shield. OUADFEUL S.-A., ALIOUANE L.

Keywords: Multiscale analysis; Wavelet transform; Boundaries; Hoggar shield; Algeria.

Abstract: In this paper, the subsurface structural boundaries of the Hoggar shield are delimited by the multiscale analysis of the potential Bouguer gravity anomaly data using the 2D directional continuous wavelet transform. The main idea is based on the mapping of maxima of the modulus of the continuous wavelet transform for the full range of scales that are used in the wavelet transform calculation; the analyzing wavelet is the Poisson's kernel. Data of the international gravimetric bureau (BGI) are used, and obtained results exhibit a big correlation with the structural map of the area.

In: Arabian Journal of Geosciences; vol. 9, n° 4, 2016, 258-8 p.

GEOMORPHOLOGIE

59: Algerian rainfall innovative trend analysis and its implications to Macta watershed. ELOUISSI A., SEN Z., HABI M.

Keywords: Identification; Rainfall spatial; Temporal; Trend; Slope variability; Test; Template; Watershed; Algeria.

Abstract: Climate and land use changes impact hydrological records and especially precipitation time series, which have significance priority in any water resource planning, operation, management, and maintenance studies. In this paper, Macta watershed monthly precipitation records at 25 stations are studies by the innovative trend analysis method application in order to identify the climatological tendencies in each station leading to the regional variation pattern in the precipitation over the study area. For this purpose, innovative trend template is prepared separately for each station.

The comparison of the arithmetic averages provides the trend slope in the meteorological records and the standard deviations provide a measure of variability. These templates also provide qualitative interpretations about the "low," "medium", and "high" precipitation range trends. It is noticed that there is the sub-region of decreasing trends in the northern part close to the Mediterranean Sea coastal area in the Macta basin, whereas at the south, the trends are in the increasing style. It is noticed from the quantitative analysis that in the Macta watershed "low" and "medium" rainfall ranges have commonly notrend cases, but "high" rainfall values have decreasing trends.

In: Arabian Journal of Geosciences; vol. 9, n° 4, 2016, 303-12 p.

60: Etude des sols. Description, cartographie, utilisation. GIRARD M.-C. , SCHVARTZ CH., JABIOL B.

Mots-clés: Sol; Sciences de la terre; Pédologie; Dégradation; Pollution; Valorisation.

Résumé : Destiné aux étudiants en licence et Master (Sciences de la Vie et de la Terre) ainsi qu'aux élèves préparant le BTSA, cet ouvrage s'adresse également aux professionnels de l'enseignement du territoire et de la protection des milieux naturels.

Quelles sont les relations entre dégradation des terres et alimentation des hommes ? quelle est la biodiversité d'une terre polluée? Quel est l'effet des zones humides sur l'environnement ? En répondant à ces interrogations, ce manuel présente les éléments de science du sol et aborde la notion de couverture pédologique dans son rapport avec l'espace et le temps. La place du sol dans les préoccupations majeures, telles que dégradation, pollution et valorisation, est également traitée.

In:Ed. Dunod; 2011, 404 p.

61: Spatial and temporal variability of the rainfall erosivity factor in Northern Algeria. MEDDI M., TOUMI S., ASSANI A.A.

Keywords: Rainfall erosivity; Erosion; Model; Map; Wischmeier R factor; Northern Algeria.

Abstract: Erosion, sediment transport, and deposition result in agricultural soil degradation, dam siltation, and significant and costly damage. In Algeria, despite a decrease in total rainfall, especially in the central and western parts of the country, dam siltation and erosion are on the rise according to recent studies by the National Agency of Dams and Transfers. Developing a map of the spatial variation of rainfall erosivity will provide a powerful tool for land and dam managers. Erosivity can be quantified using the *R* factor from the Universal Soil Loss Equation. The purpose of this work is to develop a model for estimating rain erosivity based on the modified Fournier index (MFI), longitude, altitude, and mean maximum daily rainfall, and then to produce a map of the spatial distribution of erosivity in Northern Algeria. The *R* factor reaches a maximum value of roughly 905 MJ mm ha^{-1} $year^{-1}$ in the Jijel area of Mediterranean Eastern Algeria and a minimum value of 37 MJ mm ha^{-1} $year^{-1}$ in the southern portion of the study area. The study of the temporal evolution of annual rainfall erosivity index (*R*) and I_{max} over 30 min showed that *R* recorded a negative trend and I_{max} recorded no trend.

In: Arabian Journal of Geosciences; vol. 9, n° 4, 2016, 282-13 p.

GEOLOGIE DE L'INGENIEUR

62: Rapport sur les glissements de terrains dans les régions d'Alger –Ben Aknoun, Bouzaréah et Télémly. AGENCE DU SERVICE GEOLOGIQUE DE L' ALGERIE.

Mots-clés: Glissement; Effondrement; Mouvement; Phénomène géologique; Ben Aknoun; Bouzaréah; Télémly; Alger; Algérie.

Résumé: Dans le cadre des missions qui lui sont dévolues par la loi minière, notamment en matière d'infrastructure géologique, et suite aux instabilités de terrains qui se sont déclarées dans la wilaya d'Alger, au mois de Novembre 2016, l'Agence du Service Géologique de l'Algérie (ASGA) a intervenu par le biais d'une équipe d'ingénieurs géologues qui s'est déplacée sur les sites concernés pour dresser un état des lieux et déterminer les causes des glissements.

Au cours de cette mission, trois sites ont été visités, à savoir :

- L'effondrement survenu au niveau de l'autoroute, à proximité de l'entrée du parc zoologique de Ben Aknoun,
- Le glissement de terrain au niveau de la route de l'observatoire à Bouzaréah et ;
- Le glissement de terrain de la rue Blaise Pascal, en aval du Boulevard Bougara, entre les quartiers d'El Biar et du Télémly.

Ces phénomènes géologiques et naturels dus généralement à la nature des terrains (lithologie, fracturation, pendage, …), sont accélérés par des actions anthropiques.

In: Agence du Service Géologique Algérie; 2016, 22 p.

63: Landslide hazard mapping in the Constantine city, Northeast Algeria using frequency ratio, weighting factor, logistic regression, weights of evidence, and analytical hierarchy process methods. BOURENANE H., GUETTOUCHE M.S., BOUHADAD Y., BRAHAM M.

Keywords: Landslide hazard maps; GIS; Frequency ratio; Weighting factor; Logistic regression; Weights of evidence; Analytical hierarchy process; Constantine; Algeria.

Abstract: Landslides constitute the most widespread and damaging natural hazards in the Constantine city. They represent a significant constraint to development and urban planning. In order to reduce the risk related to potential landslide, there is a need to develop a comprehensive landslide hazard map (LHM) of the area for an efficient disaster management and for planning development activities. The purpose of this research is to prepare and compare the LHMs of the Constantine city, by applying frequency ratio (FR), weighting factor (Wf), logistic regression (LR), weights of evidence (WOE), and analytical hierarchy process (AHP) methods used in a framework of the geographical information system (GIS). Firstly, a landslide inventory map has been prepared based on the interpretation of aerial photographs, high resolution satellite images, fieldwork, and available literature. Secondly, eight landslide-conditioning factors such as lithology, slope, exposure, rainfall, land use, distance to drainage, distance to road, and distance to fault have been considered to establish LHMs using the FR, Wf, LR, WOE, and AHP models in GIS. For verification, the obtained LHMs have been validated comparing the LHMs with the known landslide locations using the receiver operating characteristics curves (ROC). The validated results indicate that the FR method provides more accurate prediction (86.59 %) of LHMs than the WOE (82.38 %), AHP (77.86 %), Wf (77.58 %), and LR (70.45 %) models. On the other hand, the obtained results showed that all the used models in this study provided a good accuracy in predicting landslide hazard in Constantine city. The established maps can be used as useful tools for risk prevention and land use planning in the Constantine region.

In: Arabian Journal of Geosciences; vol. 9, n° 2, 2016, 154-24 p.

64: Geographical information systems in assessing natural hazards. CARRARA A., GUZZETTI F.

Keywords: Natural disasters; Data processing; Natural hazards; Geographic information systems.

Abstract: The 16 contributions to Geographical Information Systems in Assessing Natural Hazards report on GIS investigations into landslides, floods, volcanic eruptions, earthquakes and groundwater pollution hazards. Current methods for predicting extreme events are critically discussed, the emphasis being on the intrinsic complexity of this type operation, requiring many spatial data, long historical records and sound models of the physical processes involved. Within this context, the potentials and limitations of GIS are addressed in terms of data acquisition, spatial data structures and modeling for simulation of the causal phenomena.

Geographic Information Systems in Assessing Natural Hazards will help investigators in both public and private institutions to evaluate the actual effectiveness of GIS in coping with natural disasters, and to develop new strategies for projects aimed at the assessment and mitigation of the effects of such catastrophic events.

In: Coll. Advances in natural and technological hazards research; 1995, 354 p.

65: Enrichment and geoaccumulation of heavy metals and risk assessment of sediments from coast of Ain Temouchent (Algeria). KOUIDRI M., DALI YOUCEF N., BENABDELLAH I.

Keywords: Heavy metals; Sediments; Geo-accumulation index; Enrichment factor; Ain Temouchent; Algeria.

Abstract: The present study was undertaken for assessing the level of heavy metals such as iron, copper, zinc, lead, and cadmium in surface sediment samples of the coast of Ain Temouchent (north-western of Algeria). Sediment samples were obtained from Zouanif, Rachgoun, Beni saf, and Sidi ali during a period between March 2012 and February 2013. The samples were digested using a mixture of acids and the metal content determined using atomic absorption spectrophotometer (AAS). Heavy metal concentrations in sediments show significant variability and ranges from 16.30 to 32.15 mg/g for Fe, 12.49-31.25 mg/kg for Cu, 120.17-193.31 mg/kg for Zn, 25.94-57.27 mg/kg for Pb, and 1.45-16.84 mg/kg for Cd. The results revealed relatively high metallic concentrations of Zn, Pb, and Cd in sediments at the four stations and exceed the background values. The sediment pollution assessments were carried out using a geoaccumulation index (Igeo) and enrichment factor (EF). The results of geoaccumulation index reveal that sediments are uncontaminated with Fe and Cu, uncontaminated to moderately contaminated with Zn and Pb, and moderately contaminated with Cd. The calculation of enrichment factors showed that Cu is depleted, whereas Zn and Pb are moderately and Cd is severely enriched. Metal concentrations were significantly high between stations. Industrial and agricultural activities and a near by municipal dumpsite were associated with the higher elemental concentrations particularly at Rachgoun and Beni saf. ANOVA test was used to compare the levels of the metals in different stations (inter-station comparison). Principal component analysis (PCA) was applied to investigate the sources affecting surface sediment samples at the stations.

In: Arabian Journal of Geosciences; vol. 9, n° 5, 2016, 354 – 9 p.

66: Mapping the chemical environment of urban areas. JOHNSON CH. C., DEMETRIADES A., LOCUTURA J.

Keywords: Soil pollution; Urban pollution; Environmental geochemistry; Geochemical mapping.

Abstract: Mapping the chemical environment of urban areas presents a comprehensive overview of the methods currently being employed to map and interpret the distribution of chemical elements and organic compounds in our towns and cities.

Clearly structured throughout, the book is divided into distinct sections. The first part covers more general aspect of urban chemical mapping with an overview of current practice, and reviews of different features of the component methodologies (chemical analysis, quality control, data interpretation and presentation, risk assessment, etc.). The second part includes a number of case studies from different urban areas, principally from Europe, but with some contributions from North America, Africa and Asia, authored by those national of academic institutions tasked with investigating the chemical environment of their major urban centres. An informative list of abbreviations and acronyms, used in the text, is included and many of the chapters define terms frequently employed in geochemical mapping that will help researchers give more clarity to the way in which such work will be described in the future.

Chapters include strategies that can be employed to map urban environments, along with sampling procedures, which are used for a variety of sample media. Analytical methodologies for determining chemical elements and compounds are covered and their relative merits and disadvantages presented. Methods for defining element associations and what areas can be considered contaminated are documented, as are techniques for distinguishing between the natural chemical baseline and chemicals and compounds introduced by human activity. Many of the chapters discuss the potential impact on human health and describe the multi-disciplinary effort, usually supported by legislation, required to deal with the legacy of contamination found in many urban areas.

In: Ed. Wiley-Blackwell; 2011, 616 p.

67: Satellite imagery and airborne geophysics for geologic mapping of the Edembo area, Eastern Hoggar (Algerian Sahara). LAMRI T., DJEMAÏ S., HAMOUDI M., ZOHEIR B., BENDAOUD A., OUZEGANE KH., AMARA M.

Keywords: Airborne geophysics; Remote sensing; Geological mapping; Edembo terrane; Eastern Hoggar; Algeria.

Abstract: Satellite imagery combined with airborne geophysical data and field observations were employed for new geologic mapping of the Edembo area in the Eastern Hoggar (Tuareg shield, Sahara). Multi-spectral band fusion, filtering, and transformation techniques, i.e., band combination, band-rationing and principal component analysis of ETM+ and ASTER data area used for better spectral discrimination of the different rocks units. A thematic map assessed by field data and available geologic information is compiled by supervised classification of satellite data with high overall accuracy (>90%). The automated extraction technique efficiently aided the detection of the structural lineaments, i.e., faults, shear zones, and joints. Airborne magnetic and gamma-ray spectrometry data showed the pervasiveness of the large structures beneath the Paleozoic sedimentary cover and Aeolian sands. The aeroradiometric K-range is used for discrimination of the high-K granitoids of Djanet from the peralumineous granites of Edembo, and to verify the Silurian sediments with their high K-bearing minerals. The new geological map is considered to be a high resolution improvement on all pre-existing maps of this hardly accessible area in the Tuareg shield. Integration of the airbone geophysical and space-borne imagery data can hence provide a rapid means of geologically mapping areas hitherto poorly known or difficult to access.

In: Journal of African Earth Sciences; vol. 115, 2016, p. 143-158.

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